ELECTRICAL SOUTH

APRIL 1943

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52-In Hotel Type

FANS by HUNTER.CENTURY

55th SEASON

24-In "Airspread" Ceiling

HUNTER, who has made fans and ventilators exclusively during 55 years, is now operating under War Production Board restrictions. • No more fans will be made except for the Army, Navy and Maritime Commission. • HUNTER unfilled orders now on hand represent contracts with Government Agencies. • Certain sizes of belted exhaust types can be made available for Government hospitals and other war industries, subject to limited material inventories now on hand.

HUNTER FAN & VENTILATING COMPANY, INC.

Factory: FULTON, N. Y.

General Sales Offices: Memphis, Sterick Bldg. *Eastern Sales Office:* New York, 92 Warren Street *Western Sales Office:* St. Louis, 1706 Olive Street

Sales Offices:
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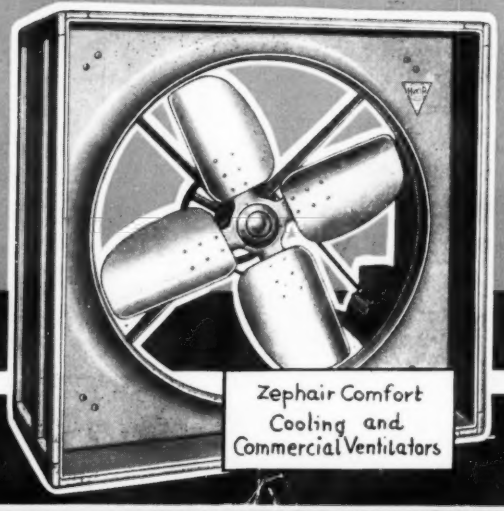
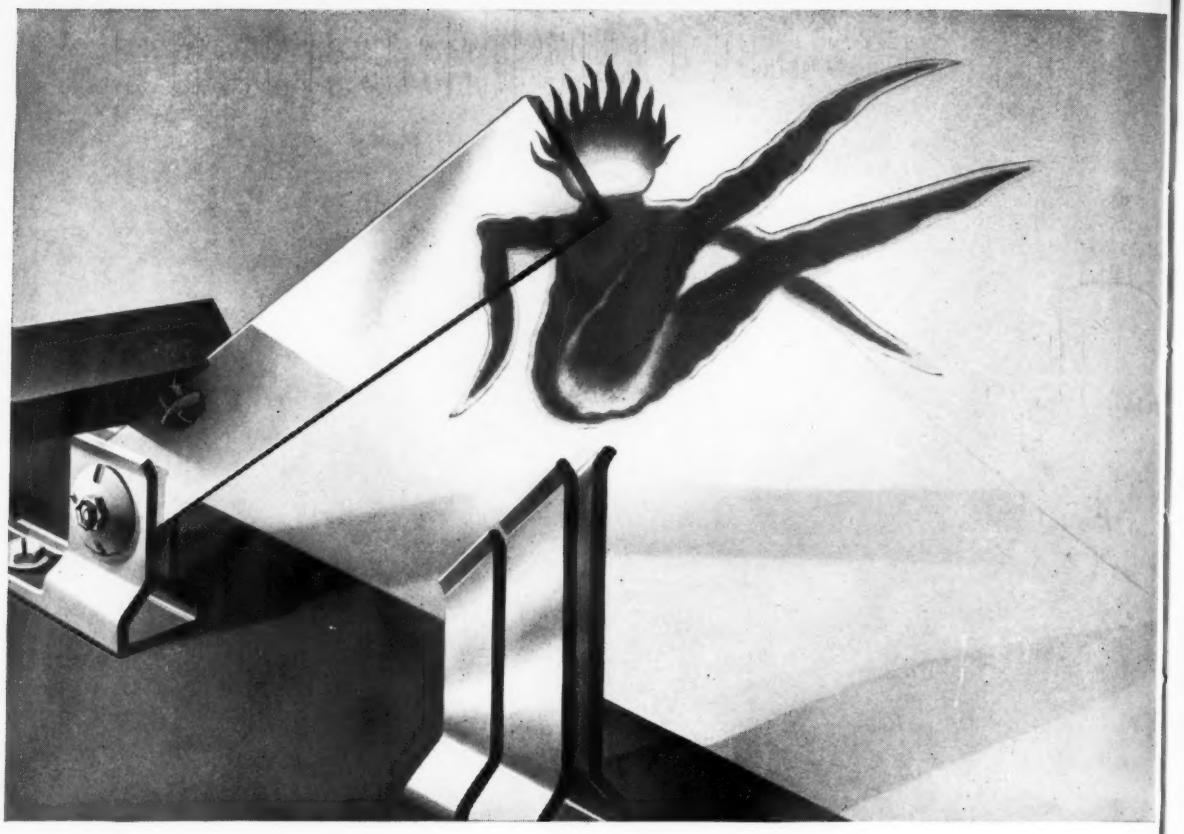
CHICAGO
DALLAS
HOUSTON
LOS ANGELES
PHILADELPHIA



Zephair Comfort Cooling and Commercial Ventilators

Sales Offices:
BOSTON
CLEVELAND
DETROIT
KANSAS CITY
NEW ORLEANS
PITTSBURGH



hot arcs get the point Quick!

Arcs burn with terrific heat when they leap between opening contacts. The heavier the load... the hotter they burn. Switch contacts get badly pitted and burnt, unless the arc is both controlled and extinguished, *quick*.

Westinghouse Safety Switches eliminate this source of trouble. The diamond-pointed jaw carries the arc outside the contact area assuring long contact life.

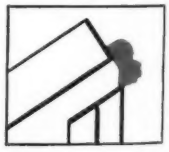
On Safety Switches, 575 and 600 volts, Westinghouse adds another protective plus—the "De-ion" arc quencher. This exclusive feature draws the arc up into the grids—divides and extinguishes it in the blink of an eye.

These advantages mean better, more dependable protection. Contacts stay clean, last longer. Time-outs for maintenance and inspection reduced.

Protect your important circuits with Westinghouse Safety Switches. Ratings up to 1200 amps, 600 volts. Call your Westinghouse representative today. Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa., Dept. 7-N.

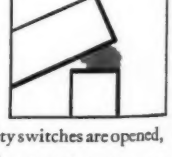
J-21266

LIKE THIS



Diamond-pointed break jaws confine arcing to the point... force the arc to break outside the current carrying areas. Contact surfaces stay clean, don't pit and burn.

NOT LIKE THIS



When ordinary safety switches are opened, the arc leaps across the contact areas ... along the jaw and blade. It hangs on longer, burns and pits the contact surfaces.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

SAFETY SWITCHES

ELECTRICAL SOUTH is published monthly by W. R. C. Smith Publishing Co., Marietta, Ga., and Atlanta, Ga., U. S. A.
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Volume 23 Number 4

We're Both on the Spot

Your problem is to transmit the greatest block of electric power, or to transport the greatest volume of traffic, or to produce the greatest quantity of material that you have ever been called upon to handle.

Our problem is to supply insulated wire and cable for the war effort and, at the same time, supply other vital needs within the limitations imposed upon us. Although our plants are running day and night to meet these demands, production is, at times, insufficient to meet other than war requirements.

We're both on the spot! If we occasionally fail to maintain prompt deliveries, we must all be patient! We are all devoting our energies to one objective—the winning of the war—but we must first follow instructions from those responsible for the direction of America's war effort.

Today, as always, we are interested in your cable problems and are glad to discuss them. Our Research and Engineering departments are developing new ideas daily and one that eliminates the use of vital war materials may be just the solution to a problem you have. May we suggest, therefore, that before placing an order for cable or wire, you consult our representative as to your needs, so that we may be more certain of filling your order and possibly expediting its delivery.

THE OKONITE COMPANY
Passaic, New Jersey
Offices in Principal Cities

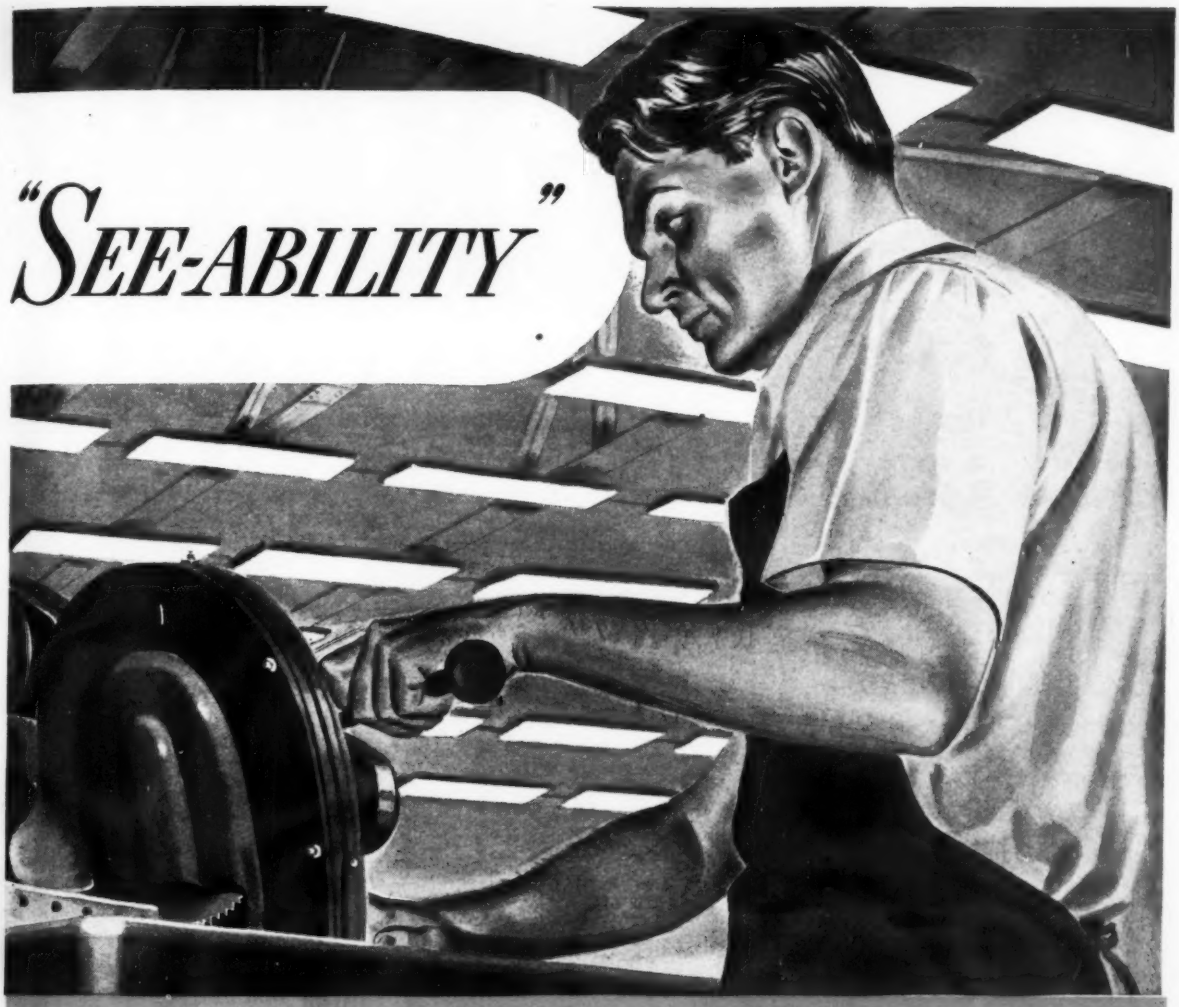
OKONITE
Insulated Wires and Cables

"BUY U. S. WAR BONDS—Every Payday All Okonite Employees BUY U. S. WAR BONDS"

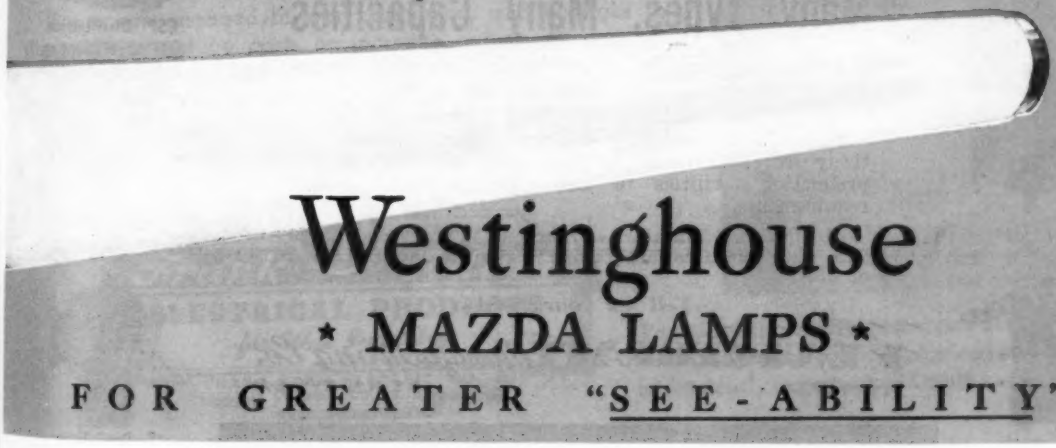
Conserve lamps for *WAR-TIME*

To maintain high levels of "See-ability" in our war factories, millions of lamps are needed, lamps requiring tungsten, copper, and other vital materials. You can help make these lamps available. Turn lights out promptly, when not in use. Keep bulbs and reflecting surfaces clean. Make periodic check-ups to be sure that your present lighting equipment is at peak efficiency.

"SEE-ABILITY" helps increase war production



By conserving in these ways, you help provide "See-ability" for war workers. They need good light to avoid accidents and lost time. They need high levels of "See-ability" to prevent damage to machinery and materials . . . to increase war production. Every extra bit of light you get from your present lamps is therefore a direct saving of a vital product for winning the war. Westinghouse, Lamp Division, Bloomfield, N. J.

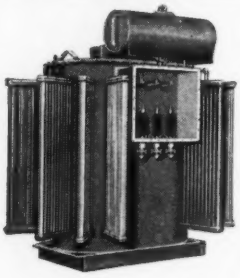


Westinghouse

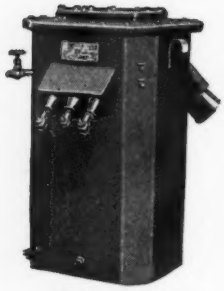
★ MAZDA LAMPS ★

FOR GREATER "SEE-ABILITY"

UPTEGRAFF TRANSFORMERS

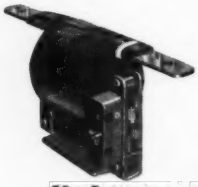


Power

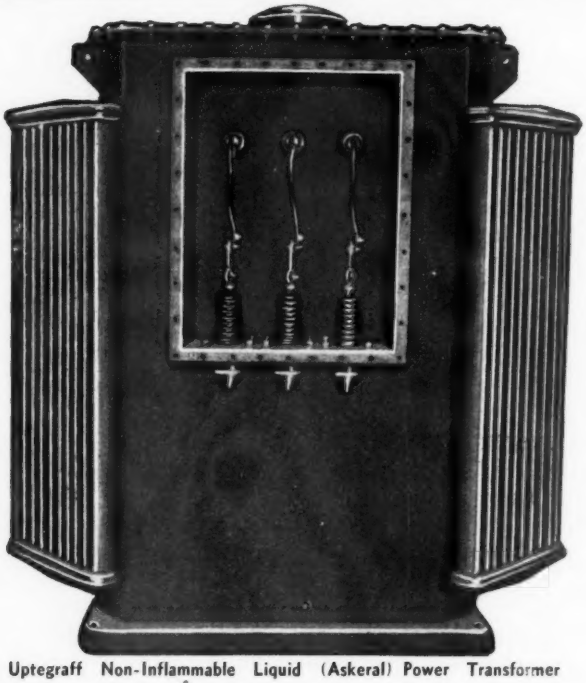


AD Distribution

DA Dry Type



CR Current



Uptegraff Non-Inflammable Liquid (Askeral) Power Transformer

Uptegraff QUALITY SERVICE

UD Distribution

CSP Distribution

PR Potential

E Dry Type

Many Types, Many Capacities

There is a sureness of service in Uptegraff Transformers of every type, that has won them high respect from Utilities, Contractors and Power Users.

Built in a modernly equipped plant devoted entirely to Transformers, and with engineering and production facilities to take care of many special requirements.

All Uptegraff Transformers are built in strict accordance with the standards of NEMA, of AIEE, of EEI, and of ASA.

Tell us your needs.

R.E. UPTEGRAFF *Manufacturing Co.*

SCOTTDALE · · · PENN'A · U·S·A·

Plants with *obsolete equipment* can not compete with those *modernly equipped...*

✓ *Check up*

on your electrical distribution system—including

- ☐ Switchboards
- ☐ Panelboards
- ☐ Safety Switches
- ☐ Wiring

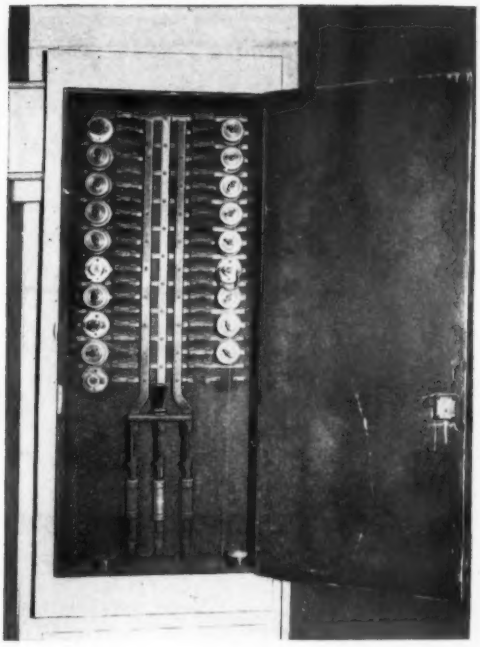
If they are not the best for the job they must do — today or after the war — plan now to replace them. Higher production costs are the penalty for not modernizing.

Consultation — without Obligation

There is an FA Sales-Engineer near you who will be glad to consult with you or your engineer and to inspect and report on your electrical system. If it is efficient and in proper condition, he will say so. If not, he will suggest changes for betterment. After that — it's up to you.

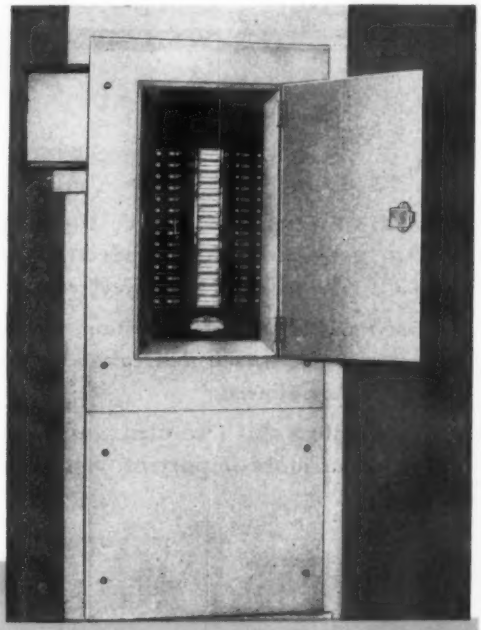
If you are engaged in war production, and changes are desirable to reduce costs or increase output, FA can give you good service. If not — we'll have to wait until Victory perches on our banner.

In either event — *Plan Now!*



This old FA Fuse-Type Panelboard had been used for many years. Still serviceable, it was obsolete — upkeep out of reason, repair parts no longer obtainable. Its *20 circuits* could not meet the demand. And the exposed bus bars and main knife-switch carried an element of danger.

Replaced with this efficient, safe and decorative FA Panelboard, *28 circuits* were installed in *one-third less space*. Modern *automatic* protection was assured by the FA Dublbrak Circuit Breakers, which also made restoration of service simple and easy. All current-carrying parts are covered.



EST. 1891 — THE SIGN OF A FA BETTER JOB

Frank Adam

ELECTRICAL PRODUCTS

for War Industry

FRANK ADAM ELECTRIC CO.
ST. LOUIS, MO. U.S.A.

For more than fifty years one of the country's leading producers of electrical equipment for industrial, commercial and residential use.

Tomorrow may be too late—do it NOW

WARTIME restrictions make copper products hard to get — this includes electrical wire and cable. It will pay you to protect what you have.

Anaconda's Preventive Maintenance Plan will help you check to see that cables in your plant are not being abused.

If you follow this free plan you not only help yourself, but more important, you help the war effort. This manual provides a practical automatic method for complete analysis of circuits and equipment... uncovers potential weaknesses ... methods for correcting them ... with charts to enable quick periodic check-ups.

NOTE: Through this Preventive Maintenance Plan you may uncover the evidence necessary to obtain an "emergency repair priority." This is explained fully in the plan book.

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

Anaconda Wire & Cable Company
25 Broadway, New York City

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding production.

Individual .....

Company .....

Address ..... City .....

1B

APRIL, 1943

Volume 23 No. 4

ELECTRICAL SOUTH

J. C. MARTIN,
Manager

W. E. COOGLER,
Production Manager

Editorial and Business Offices
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ATLANTA, GEORGIA

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Member of A. B. C.

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THREE YEARS—$2.00
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Contents

Turner Keeps Them Turning!	8
Project Organization Required on Large Jobs	12
Power Helps Win the War	14
Electronic Speed Control for Industrial Motors	17
Maintaining Cooking and Baking Equipment	21
Servicing the Refrigerator—Part 3	26
Birmingham Dealer Solves Service Problem	32
Balance Sheet Analysis for Electrical Trade	34

Departments

Practical Helps for the Trade	38
News of the Electrical Industry	46
Personal Notes About Men You Know	56
New Electrical Equipment and Materials	58

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Turner Keeps Them Turning

First of three articles describing the ingenious methods devised by J. Arthur Turner, of Tampa Armature Works, to solve unusual wartime problems.

By L. H. Houck

WARTIME methods will become peace-time methods at the Tampa Armature Works, Tampa, Florida, where 20 women are making good in a modern motor shop.

The old system of rebuilding motors with one individual carrying the job from tear-down and stripping to testing and painting has given way to streamlined production. This new system, where, nearly half the force is composed of women, is faster, more efficient and more profitable.

Since the war has decimated the best help of all industrial plants, where some are even wondering if they can continue to operate—a plan that insures full-time operation and profits is of real importance. If the plan is worth continuing after the war—it is a double feature with dishes thrown in!

Before the war Tampa Armature employed about forty persons. Since Pearl Harbor, they have lost 80 per cent of their force, 23 going to the armed forces, 10 to shipyards.

Increased business brought their volume up 25 per cent, according to J. Arthur Turner, president, and this required more room. With 80 per cent of his employees gone off to war, it was not a pretty picture.

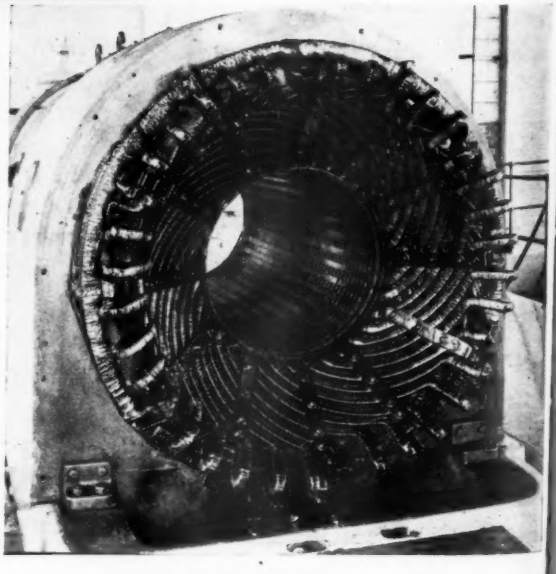
J. Arthur Turner, president of Tampa Armature Works, of Tampa, Florida, is solving successfully many of the problems of the motor rewinding industry brought about by war conditions.

The labor problem had to be whipped first.

"Obviously," Mr. Turner said, "we had to turn to unskilled labor when we found it impossible to employ skilled mechanics. We started employing older men, young men with physical handicaps, and women. We now have several men with physical handicaps who have learned to do good work. We have 65 employees, now.

"We learned a lot about women!" Mr. Turner continued. "First we discovered that younger women, particularly those who had never worked or had responsibility, did not make desirable employees in an electrical shop. Women who make the best employees, which means they like their job and need to earn money, are those between the ages of 30 and 40. Those with previous factory experience are best. Those with laundry experience are used to working with their hands and pick up our work quickly.

"We obtained our women employees by inserting a blind ad in local



Typical of some of the larger jobs recently completed in this Tampa shop is the 5,000 hp turbine generator shown here.

Twenty women are making good at motor work in the Tampa Armature Works, of Tampa, Fla.

newspapers soliciting applications," Mr. Turner said. "Replies were asked for in writing, and from those answering we sent a standard application blank, still keeping them in the dark regarding the place of employment and the kind of work."

When the company first assembled this inexperienced force, it became apparent some production system would have to be devised. It was impossible for a shop foreman to supervise so many unskilled employees. Mistakes could easily run into money, and wasted material in war time could not be endured.

Mr. Turner overcame this difficulty by setting up several departments and putting trained men, designated as sub-foremen, in charge of about ten unskilled employees each.

They found that only a small portion of their work required the services of a skilled electrician. So they specialized their new employees.

For instance, cleaning cores and stripping out the old windings, cleaning up the housings, is always a dirty and disagreeable job, so they hired men for that purpose, men who were accustomed to doing that kind of work. Negroes work well on these jobs.

"We installed an insulation department," Mr. Turner said, "and found that our cost could be materially reduced when insulation was cut by one man while the coils were being made. We designed several size wooden boxes, arranged with compartments to accommodate the slot paper, middle sticks, top sticks, phase separators, lead wire. tape, etc. The various pieces of insulation are placed in the proper compartments and the box carried to the coil department, where the coils are also put into it. By using this method, a winder receives the job to be rewound with complete insulation and coils.

"To facilitate this method," Mr. Turner continued, "it was necessary to design a data card made in three sections and perforated, with each section bearing the same number. The top section of the card designates the nature of the job to be done, the make and work order number, date, customer's name and address, motor name plate data, size of wire, number of wires in parallel, number of turns, the coil spread, which side of the stator or rotor the connection is made on and the number, size and length of motor leads to be brought out.

"This card also designates the winding connection and signifies the number of coils to be made and if wound in uneven groups, how many there are in each group, and even the length of the phase leads.

"The center section of the card is printed on both sides," Mr. Turner said, "listing standard materials and providing spaces in which the number of pieces and the size of each piece of material can be indicated. The blank space on the back of the card can be used to record the number of pounds and the size of magnet wire used. This section goes to the insulation department where the insulation can be cut while the coils are being made. After the job is wound, the center section goes to the office where the material used can be priced and charged against the job with the labor.

"The bottom section of the card is made in the shape of a shipping tag and is attached to the motor frame," Mr. Turner said. "This section of the tag has the customer's name, address, our work order number and date. On the back of this section of the card can be indicated whether the motor is assembled standard, assembled opposite standard, whether it has rails, sliding base, pulleys, pinion, coupling, V-sheave or brake drum.

"The section of the card that goes to the coil department will go to the winder with the set of coils and insulation so that the winder will have the necessary winding data."

The card was almost as important in routing the work and keeping track of materials as was the training of new unskilled employees.

Before putting women employees to work, they found it best to assemble them in the company school. Here in a room with a teacher and a blackboard they became acquainted with the different materials to be used, and why such particular materials were selected for a particular use. By having an armature and a stator in the classroom, the cores and frame could be insulated and explanation made as to why the insulation was put in a paticular place. The blackboard was used for diagrams showing wave and lap connected windings and acquainted them with the company's standardized way of taking armature and motor data.

Early in the history of the school at the Tampa Armature Works, it was found necessary to have two classes—one for beginners and one for the more advanced. This enabled the more advanced to progress further and helped to keep them interested.

Tampa Armature Works has a standard way of marking the coil spread and commutator connections. When facing the commutator, they mark the slot and the commutator on the left with a cross mark and the right slot and commutator with center punch marks. In addition, they fill in a data card with the same information so that if the commutator has to be removed it can be replaced and connected properly from the data card.

Next they gave the new employes a course in the study of open circuits, short circuits and grounds. In this course, they were taught the names of various parts, such as armature, shaft, commutator, core, fan, and learned such facts as why the winging cannot protrude too far from the core.

Next, they were taught to place the wires in the commutator rise and also to make wire splices as used on end connections on small motors. After this they were taught how to solder the commutator connections and wire splices.

Throughout the course brief talks were made bringing out the importancce of the work and the importance of keeping war industries operating, and an effort was made to get each employee to feel that she was really embarking on a new career—a career that is important, has earning capacity, and one that will materially help in the war effort.

One experienced armature winder can best supervise about six women employees, according to the experiences gained at Tampa Armature Works.

Mr. Turner said, "We are sure the preliminary training is well worth the time, effort and cost.

"In training young physically handicapped male employees," Mr. Turner continued, "we use the lessons as prepared by F. W. Willey, of the Willey-Wray Electric Company, Cincinnati, past president of the National Industrial Service Association, as we find that this study course is the best we have been able to obtain. Much credit should go to Mr. Willey for its preparation."

In two future articles, other features of the Tampa Armature Works will be described. One of these will provide complete details on a new type of motor data record card and a novel Kardex system for keeping account of customer priorities. The third article will discuss methods of reducing inventories and conservation of floor space for expanded operations.

●

On the following page are reproduced both sides of the special motor rewinding specification card used so advantageously by Tampa Armature Works. At upper right is Orelan R. Carden, superintendent, filling out one of the production cards.

~~ROTOR~~
3 PHASE STATOR WINDING DATA

WESTINGHOUSE

Nº 195

W. O. No. 4460 Date 3-10-43

Name Tampa Shipbuilding Company

Address Tampa, Florida

5 H. P.	1200 R. P. M.	220 VOLTS	3 PHASE

Serial No. 6456931 Style No. 564321

Wire Size No. 15 Wires in Par. 2

Coil Spread 1+ 10 No. of Turns 12

Facing Name Plate Connection On: x Right; Left; Front; Back

Bring Out: 3; 6; x 9; 12; 13

No. 10 Leads 6 " Long

Connections: x 1 Cir. 2 Cir. Y ▲ Cir. Cir. Speed Winding

Make: No. of Slots 12 Groups 3 coils; 18 No. of Coils 18 Short Leads 4 "; 6 Groups 2 coils 18 Long Leads 8 "

INSULATION SPECIFICATIONS Nº 195

Customer Tampa Shipbuilding Company

W. O. No. 4460 Date 3-10-43

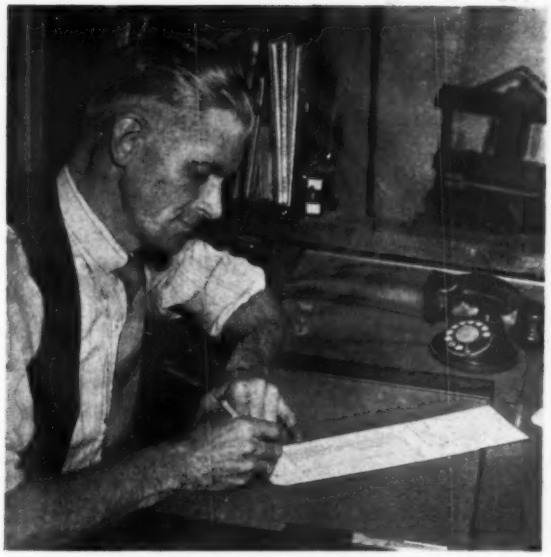
No. Pieces	MATERIAL	SIZE	Unit of Meas.	COST
	.005 Fish Paper	X		
	.007 Fish Paper	X		
	.010 Fish Paper	X		
	.010 Red Press Board	X		
	.020 Red Press Board	X		
	.010 Manning Paper	X		
	.015 Manning Paper	X		
	.020 Manning Paper	X		
	.012 Combination Paper	X		
48	.022 Combination Paper	4 X 5		
	.007 Black V.C. Cloth	X		
	.010 Black V.C. Cloth	X		
	.015 Black V.C. Cloth	X		
	Untreated Canvas	X		
	12 oz. Untreated Canvas	X		
18	.015 Treated Canvas	5 X 5		
	Treated Canvas	X		
48	1/32" Fiber	.250 X 7"		
	1/16" Fiber	X		
	1/8" Fiber	X		
	1/16" Phenolite	X		
	3/16" Phenolite	X		
	.015 Flex. Mica	X		
	.012 Micanite	X		
	.015 Super-Micanite	X		
	.020 Moulding Mica	X		
	.025 Moulding Mica	X		
	.030 Moulding Mica	X		
	.035 Moulding Mica	X		
	.020 Segment Mica	X		
	.025 Segment Mica	X		
	.030 Segment Mica	X		
	.035 Segment Mica	X		
	.040 Segment Mica	X		
	.060 Segment Mica	X		
	V. C. Tubing Mica, No.	" long		
	V. C. Tubing Mica, No.	" long		
	Cotton Sleeving Mica, No.	" long		

Name Tampa Shipbuilding Company

Address Tampa, Florida

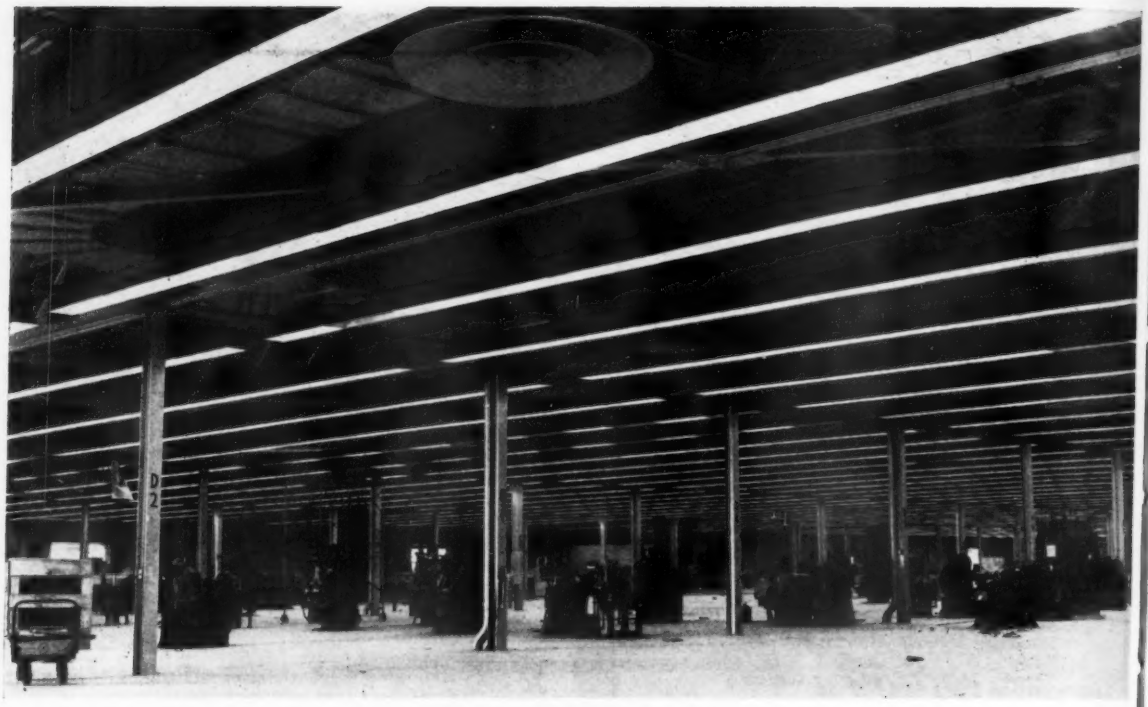
W. O. No. 4460 Date 3-10-43

Nº 195



No. Pieces	MATERIAL	SIZE	Unit of Meas.	COST
48	Top Sticks No. 3	5⅛ " long		
	35 amp. soldering lugs			
9	50 amp soldering lugs			
	70 amp. soldering lugs			
	90 amp. soldering lugs			
	125 amp. soldering lugs			
	175 amp. soldering lugs			
	250 amp. soldering lugs			
	325 amp. soldering lugs			
	Rolls Friction Tape			
	Rolls ½" Cotton Tape	.00		
1	Rolls ¾" Cotton Tape	.005		
	Rolls ¾" V. C. Tape	.00		
	No. 18 Motor Lead Wire-600V	ft. in.		
	No. 16 Motor Lead Wire-600V	ft. in.		
	No. 14 Motor Lead Wire-600V	ft. in.		
	No. 12 Motor Lead Wire-600V	ft. in.		
1	No. 10 Motor Lead Wire-600V	9 ft. 6 in.		
	No. 8 Motor Lead Wire-600V	ft. in.		
	No. 6 Motor Lead Wire-600V	ft. in.		
	No. 4 Motor Lead Wire-600V	ft. in.		
	No. 2 Motor Lead Wire-600V	ft. in.		
	No. 0 Motor Lead Wire-600V	ft. in.		
	No. 10 Motor Lead Wire-2300V	ft. in.		
	No. 8 Motor Lead Wire-2300V	ft. in.		
	No. 6 Motor Lead Wire-2300V	ft. in.		
	No. 4 Motor Lead Wire-2300V	ft. in.		
	No. 2 Motor Lead Wire-2300V	ft. in.		
	No. 0 Motor Lead Wire-2300V	ft. in.		
	No. 00 Motor Lead Wire-2300V	ft. in.		
	11 lbs. No. 15 SCE Mag. wire			

x Assembled Standard	x Terminal Block Cover
Assembled Opposite Standard	Pinion
x Rails	Coupling
Sliding Base	x V-Sheave 5G 6" Dia.
Pulley Size	Brake Drum
Terminal Block	



This view of the machine shop of one of the projects recently completed by Juneman Electric Company is typical of the large projects in which this company has specialized. It contains three miles of lamps!

Careful Project Organization Required on Large Jobs

By George H. Watson

CAREFUL organization for project control is one of the principal factors in the Juneman Electric Company's successful completion of millions of dollars worth of war contracts in the past two years. Operated by George Juneman, of Birmingham, Alabama, this company has utilized the services of as many as 950 electricians at one time. The number, of course, varied according to the progress of the work. Men were supplied by local unions, who sometimes had to call on distant locals to supplement the supply.

The accompanying organization chart shows how responsibility and authority were delegated throughout the organization. From the chart it will be noted that a project manager and an assistant project manager report directly to Mr. Juneman. Under them are the superintendents of outside construction, superintendents of inside construction, and the supervisors of the warehouse, auditing, purchasing, and of engineering.

Under each department head, of course, are the necessary clerks, foremen, and workmen.

George Juneman

Of particular interest is the special arbitration board, consisting of one outside electrician, one inside electrician, and a representative of the contractor, to handle any labor trouble in the Juneman organization.

Mr. Juneman was one of the first electrical contractors to specialize in this type of work. Ever since he went in business for himself in 1936, after several years with another electrical concern, his service has been largely to industrial and commercial concerns, and he still keeps two trucks busy, largely serving plants engaged in war production. Thus it was comparatively easy for him to branch out and handle gigantic jobs, not usually associated with peace-time operations.

Even before Pearl Harbor, Mr. Juneman had the sub-contract under Rust Engineering Company, of Birmingham, for some $500,000 worth of electrical work at the Gadsden Ordnance Plant. The

plant covers a 330 acre site with 23 buildings, and all utilities are located underground as a protective measure. The total connected motor and high frequency induction furnace load is approximately 6,000 horsepower. The machine shop alone has over three miles of fluorescent lighting and a 1,200-ton air conditioning job.

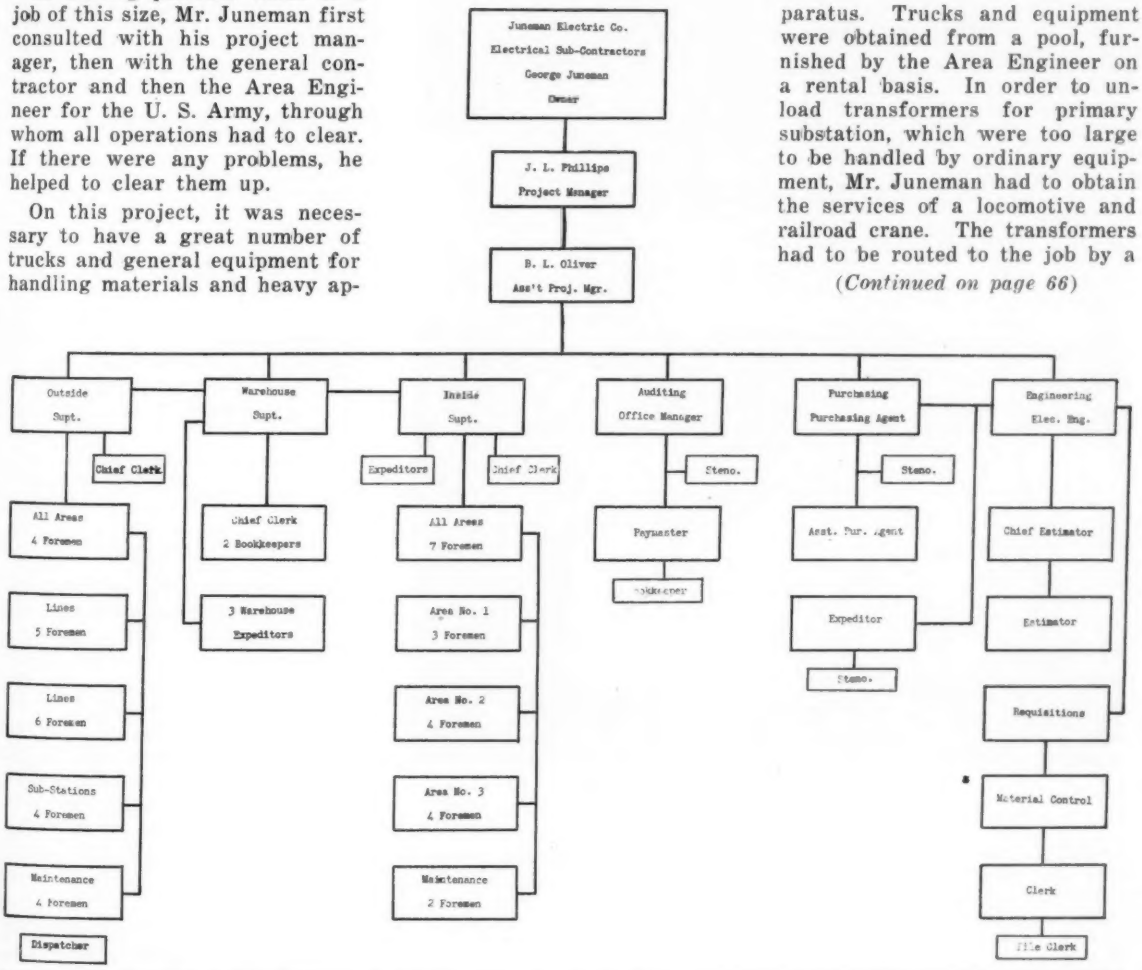
But as big as this job is, it is dwarfed by the Huntsville Arsenal Project, consisting of Chemical Warfare Service and the Redstone Ordnance Plant. The electrical work on this project, which covers an area of 80 square miles, amounted to approximately $4,000,000. From a group which included several nationally known electrical contractors, Juneman Electric Company was selected by Kershaw, Butler, Engineers, Ltd., general contractors, to handle the electrical work. This project has been under construction since November, 1941, and is slated for early completion.

In making periodic visits to a job of this size, Mr. Juneman first consulted with his project manager, then with the general contractor and then the Area Engineer for the U. S. Army, through whom all operations had to clear. If there were any problems, he helped to clear them up.

On this project, it was necessary to have a great number of trucks and general equipment for handling materials and heavy apparatus. Trucks and equipment were obtained from a pool, furnished by the Area Engineer on a rental basis. In order to unload transformers for primary substation, which were too large to be handled by ordinary equipment, Mr. Juneman had to obtain the services of a locomotive and railroad crane. The transformers had to be routed to the job by a

(Continued on page 66)

Exterior of Juneman Electric Company headquarters, in Birmingham, Below, organization chart for the $4,000,000 Huntsville Arsenal project.



Power Helps Win the War

By J. A. Krug*

THERE is only one certain way of winning the war, that is, to devote to the job all we have of material and manpower except what is needed to keep the civilian population alive and healthy. By such vigorous prosecution of the war in this year, 1943, the United States alone will produce more munitions than the combined efforts of all of the Axis countries and their vassal states.

Electric power is the life blood of war production. Regardless of the availability of materials and labor, modern war production would be impossible without power. It is needed in large quantities to refine aluminum, magnesium, copper, and most of the other critical materials. Likewise, most fabrication depends upon electric power driven equipment. For these reasons, it is reassuring to know that electric power will not be a limiting factor in all-out war production, and that wherever war loads must be carried, electric power will be there in adequate quantities.

"The war power supply job can be done only by the systems who are directly responsible for supplying power to the public. In the periods of emergency ahead, your natural ability to get the most out of what you have, will assure a continuous and adequate power supply."

War production has been following a steadily increasing curve since 1940. During 1942, the rate of increase reached its maximum. The tremendous expansion in war power requirements and all civilian needs were carried successfully by the power systems of the country. Existing installations and power plants now under construction will be adequate for the still larger requirements that are projected for 1943. However, during this year and next, the margins of safety will generally be less, and in many areas reserves will be called upon for carrying the less essential power loads. Should these reserves be required for meeting outages it will be necessary to curtail the use of power for non-essential purposes.

In the year just ended, the peak electric load on all Class I Utility Systems approximated 33 million kilowatts. This compares with the dependable capacity of 41,200,000 kilowatts. The 1942 peak load of 33 million kilowatts compares with 31,600,000 kilowatts for 1941 and 28,000,000 kilowatts for 1940. The 1942 load would have been much higher had it not been for War Time, which was put into effect in 1942 and military dimouts which were extended in 1942.

For 1943, the peak load should not exceed 38,000,000 kilowatts. The utility expansion program authorized by the War Production Board is designed to bring available dependable capacity to 45,100,000 kilowatts by the end of 1943. In the fall of 1943, however, the margin for reserves will be substantially lower, as much of the new capacity will not be ready for operation before the late months of this year.

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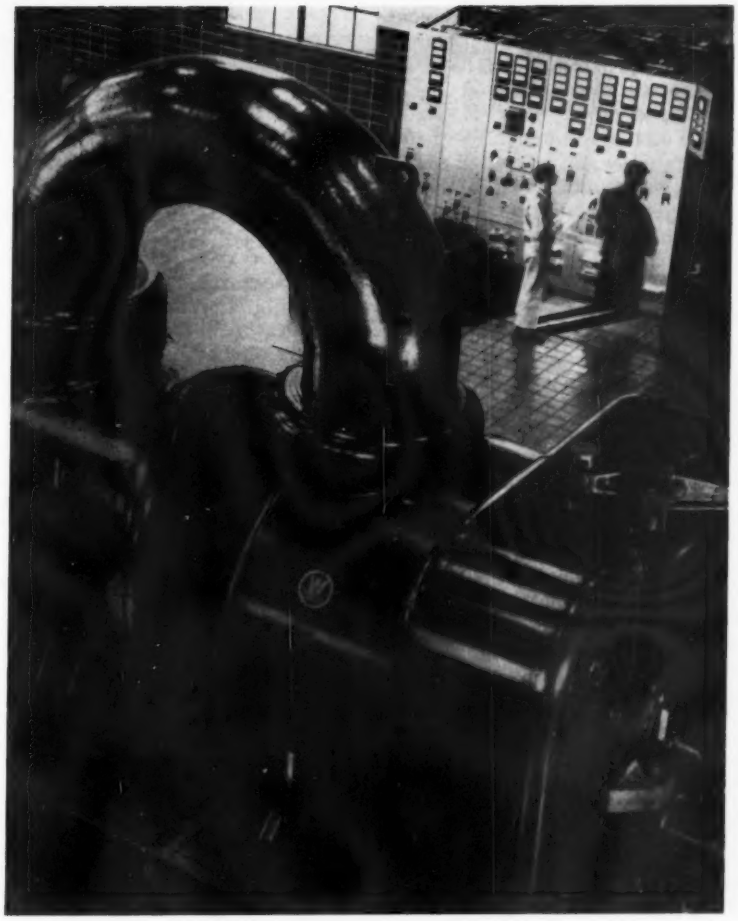
*Mr. Krug is director, Office of War Utilities. This address was presented before a meeting of TVA power distributors at Chattanooga, Tennessee.

It is unnecessary to emphasize to power men that in planning adequate power supply, over-all dependable capacity must always substantially exceed projected peak loads. Reserves are an indispensable requirement for continuity of service, and additional margins of surplus are necessary to accommodate unforeseen loads which will develop partly through unexpected war expansion and partly through unexpected shifts between programs and between areas. The power plants now under construction have been carefully selected by the War Production Board for those locations where they will contribute the maximum to maintaining operating reserves and, at the same time, provide essential margins of surplus where additional power is most likely to be used.

Reserves to Be Reduced

The program as presently planned contemplates a gradual reduction in the margins available for reserves and surpluses during the next two years. We believe that the reserve margin remaining in each year will be sufficient. In any case, there is still time to install additional capacity for 1944 should it be required. In the event that completely unexpected requirements of major magnitude appear, large amounts of new hydro and steam capacity can be provided for 1944 by making a decision to that effect as late as June 1, 1943. For just such a contingency, the power program has been so planned that numerous power installations can be completed in from 12 to 18 months. This is possible because much of the basic construction necessary for expanding capacity at existing hydro and steam plants has already been provided.

Although data as to overall supply and requirements are significant, an understanding of the situation requires analysis of conditions on a region-by-region basis. Even if expenditures for the war program in later years do not greatly exceed the amount now projected for 1943, sufficient flexibility must be preserved from area to area to accommodate the shifts in production which will accompany the inevitable changes in military requirements. On a regional basis, the power situation breaks down into three main categories: a number of major regions show a substantial power surplus; a few areas affected by peculiar conditions show tight power supply; and in the remainder of the country, supply is in reasonable balance with present and indicated requirements.



"The power men — public and private, in the TVA area and throughout the country — should be proud of the job that has been done . . . power has never been 'too little or too late.' There is today no power shortage."

(Photos Courtesy Westinghouse)

The power men—public and private, in this area and throughout the country—should be proud of the job that has been done in providing power supply. Power has never been "too little or too late". There is today no shortage of power. This is in sharp contrast to the situation as to many other vital necessities. I do not know of a single instance in which the operation of a war plant has been delayed by lack of electric power supply. Every single piece of complicated equipment, from the switches at the industrial plant back through the transformers, distribution feeders, transmission lines, to the generators in power stations, has been in place and ready to operate when the new war plants were ready for use.

I repeat, the power men of the country can be proud of the job that they are doing. But this pride is justified not alone because adequate supplies of power are being provided for the war program. The job has been done with the minimum possible interference with the rest of the war program. As you all know, the materials and equipment required by power systems compete directly for our resources in skilled labor, short metals, and limited manufacturing facilities with various phases of our most important programs—naval vessels, merchant ships, aircraft, aviation gasoline, rubber, Lend-Lease. From the out-

set, we have recognized our responsibility to assure enough power for our war program. We have also recognized our obligation not to over-build power plant at the expense of the essentials. We had to provide enough, but at the same time, we had to be sure that we were getting the utmost of our existing plant; that we were utilizing to the full the ingenuity and the resourcefulness of our utility systems to get by during this war emergency under less than ideal conditions, to assume calculated risks when necessary, not to ask for more materials and more equipment than we absolutely needed.

There have been a great many factors which have made it possible for us to do this kind of a balanced job. Not the least of these has been the high degree of technical competence of the men who operate our utility systems, public and private. I should also like to mention briefly the major factors in the planning which is producing the results I have already described.

War Time Proves Effective

War Time is important as a power conservation measure. We estimate that setting the clocks ahead an hour reduced the 1942 peak by at least a million kilowatts. The War Production Board fully realizes that War Time has caused great inconvenience to farmers generally and in some states has worked hardship on many people. Nevertheless, the War Time Statute, as applied to the country as a whole, has made a most important contribution to increasing all-out war production. The million kilowatts of power saved is sufficient to produce a billion pounds of aluminum per year. If this power capacity had not been saved, it would have been necessary to provide substantially more new facilities than our present power program contemplates. This could have been done by using scarce metals and equipment at the expense of the production of planes, ships, and munitions, and would have seriously interfered with the erection of plants so vitally needed for synthetic rubber and 100-octane gasoline.

Power pooling has been another immensely important factor in assuring an adequate power supply. Starting with the experience in the Southeast during the serious drought of 1941, the War Production Board has developed, in cooperation with major power systems, vast power pools for each critical power supply area of the country. You are all well acquainted with the pool which operated in the southeastern states so effectively during the critical months of 1941 and which can be called upon again at any time to assist power systems throughout the South. Similar pools have been established in the southwestern states, including Texas, Arkansas, Louisiana and Oklahoma; in the Far West, including California and Arizona; in the Northwest, where the great Bonneville Power System serves as a backbone for integrating all of the facilities of the region; and in the Middle West and in New England. You will be interested to know that through these pools alone, at least one and a quarter million kilowatts of additional firm power supply has been assured.

These power pools have been possible only through the most thorough cooperation of power systems, public and private. Differences of opinion and differences of policy as between systems have been pushed into the background in order that through such unselfish action war power loads may be carried with the minimum use of critical materials and labor.

Needless to say without the great public power undertakings, such as the TVA here in the Southeast, the Bonneville Power Administration in the Northwest, and the Bureau of Reclamation projects in several western states, it would have been impossible to carry out the war production program now projected. Fortunately these projects were started many years before the war. The realization that the future of this great country depended upon the maximum development of its natural resources is now reaping dividends for all of us. The TVA and Bonneville alone are providing power for well over one-half of the country's total aluminum production. It is also important to note that there are few places in the world where power can be obtained with such an over-all economy of material and labor as the additional installations in the power plants which — thanks to foresight — already exist on the Tennessee and Columbia River system.

During recent months, the newspapers have been filled with stories about production scheduling. I wish to make clear, however, that scheduling is not a new phase of the power expansion program. Since late in 1941 all major power projects have been constructed in accordance with carefully laid scheduling plans. The most critical elements—that is, the turbines—have been scheduled under War Production Board orders which fix the delivery dates for each manufacturer. All of the other critical components, such as generators, boilers, condensers, switchgear and transformers, have been scheduled in correlation with the production schedule for turbines. A sizeable staff has been working diligently to take care of bottleneck items as they appear. The power program is one of our largest construction programs. It has been carried out with relatively low priorities as compared with direct Army and Navy construction. Nevertheless, largely as a result of the scheduling operations, power plants have been completed on a schedule which has made it possible to meet all power requirements. Fortunately, it is now generally appreciated that hard work, and not high priorities, contributes most to getting the job done!

The recent action of WPB Chairman Donald Nelson establishing all war utilities as a Claimant Agency reporting directly to him on policy matters and to the WPB Requirements Committee on material requirements, should assure a continuation of construction work on all essential power projects on reasonably reliable schedules.

Curtailment Possibilities

I know that you are all interested in the prospects for power curtailment. No power man likes to think of the time when it may be necessary to deny the public the full and unrestricted use of electric power. I have mentioned that curtailment of non-essential power uses might be necessary in areas where we encounter unforeseen essential power loads. Obviously, that could not be justified when you consider that every turbine taken for power systems denies the country a propulsion unit for a war ship. Accordingly, it may be said that non-essential power uses will be carried only by system reserves. If and when these reserves are required for the purposes for which they were provided, non-essential power uses must be eliminated so that

(*Continued on page 64*)

Electronic Speed Control For Industrial Applications

By S. D. Fendley*

THE EXPERIENCE and knowledge obtained from the use of thyratron-tube motor control for more than a decade have made possible the development of a new electronic variable speed drive with features and characteristics that make it ideally suited to a vast number of industrial applications.

The versatility of this new drive, which has already been applied extensively, is made possible by a new adjustable-voltage electronic control system, called "Thymo-trol." This control in combination with a suitable motor provides a variable speed drive with features which are not ordinarily found in other conventional drives.

This electronically controlled motor drive was not developed with the idea that it can or will supplant the various other types of mechanical and electrical drives in use today, where such drives have the characteristics and provide all the features needed. The development has been carried on rather to evolve an electronic drive providing features not inherent in conventional drives where close speed regulation, smooth acceleration, precise control of speed, and other similar features are desirable. However, it is believed that this type of drive offers both the user and builder of machinery an equipment ideally suited to his needs.

The standard drive of this type consists of an anode transformer, a control and rectifier panel, a push-button station or other control accessory, and a d-c driving motor.

In some instances, a smoothing reactor may also be required, depending upon the size and characteristics of the motor being used.

Anode Transformer

The anode transformer is used in order to make use of motors of standard voltage. By designing a special motor, it would be possible to eliminate this item entirely in most cases, but it is felt that the use of a motor of standard design has some definite advantages to the user.

The transformer is of conventional design and may be either of the insulating or of the autotransformer type. It is generally supplied as a separate item to keep to a minimum the size, weight and cost of the rectifier cabinet in which it might otherwise be located.

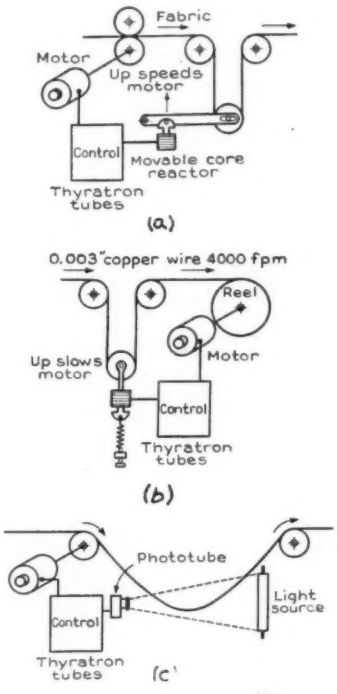


Fig. 1. Typical examples of mechanical "feed back" systems used to regulate motor speed. In (a) a loop of material being processed is used to operate the movable core of a reactor—part of a phase shifting bridge. The speed of the motor is in proportion to the rise and fall of the loop. (b) A similar arrangement with loop of material counter balanced by spring. (c) Where it is not possible to use a mechanical arrangement employing the reactor, the motor speed can be controlled through the use of a photoelectric arrangement. As the loop rises or falls, it varies the amount of light reaching the photocell and adjusts speed of the motor.

Control and Rectifier Panel

Fig. 2 (right) shows a conventional type of control panel. It consists of a suitable base on which is assembled the control and power tubes, a line contactor, a thermal overload relay, a field-failure relay, a cathode-protective timer and the necessary transformers, and other material required for the electronic circuit. Suitable anode fuses are provided for protection against short circuits.

The panel is hinged in the stationary part of the enclosing cabinet and by loosening suitable screws it can be swung completely open so that the parts and wiring are readily accessible.

The control tubes and other parts associated with them are mounted on an individual sub-panel which can be removed quickly and replaced by another unit with little loss of time.

The control accessory (Fig. 2—left) is a standard heavy-duty-type push-button station in which are mounted the necessary number of momentary contact units and the speed-adjusting potentiometer. Both the speed-adjusting potentiometer and the momentary control units may be supplied as separate items which the user can mount in any convenient location.

A shunt-wound d-c motor is used. In order to make more economical use of the rectifier tubes, 230-volt machines are ordinarily supplied.

Although the motor is of conventional design, its characteristics must be such that it will operate satisfactorily from an unfiltered rectifier supply. This is particularly true when the a-c power supply is single-phase.

Electrical Characteristics

One of the characteristics of a good drive is that it should be capable of starting its load with a minimum of shock to the machine and under conditions which will per-

*Mr. Fendley is associated with the General Electric Company's industrial control department, Schenectady, New York.

mit the motor to commutate satisfactorily. From an engineering point of view, the accelerating scheme employed in this drive is one which does approach this ideal. It is termed constant-current limit acceleration. By means of an adjustment in the panel, it is possible to vary the accelerating current and thus the accelerating torque to a value which will bring the motor to operating speed in the quickest time consistent with the nature of the load and the commutating ability of the motor.

From the moment the start button is pressed, the motor will assume a maximum value of current as determined by the adjustment. Under these conditions the motor will pull with smooth, uniform torque until the load is up to speed, then the current will drop off to the value needed to maintain the required torque.

For many applications, it is desirable to preset the speed at which the motor is to operate anywhere within the operating range. This type of equipment provides this feature so that the motor will be accelerated smoothly up to the speed called for by the setting of the potentiometer. The motor is always started under full-field conditions regardless of whether the potentiometer is set for operation below base speed by armature voltage control or above base speed in the field weakening range.

Protection against sustained overload is provided by means of a conventional thermal overload relay.

Quick stopping of the motor is provided by means of conventional dynamic braking. When the stop button is pressed, the power is disconnected and a resistor is connected across the armature.

The speed-range obtainable with equipment of this type is largely a function of the size and type of motor employed. The range, theoretically, is something from a value approaching zero up to the maximum for which the motor is designed to operate by field weakening. The practical limits are largely determined by the heating and stability of the motor. From tests which have been made it appears that the motors can be operated over a range of up to 20 to 1 below base speed by armature control on an intermittent basis without exceeding a dangerous temperature rise, and as high by field control as the motor is designed to operate. Much, however, depends upon the nature of the load to be handled, the duty cycle, etc.

By providing closely regulated armature voltage and automatic compensation for RI drop, this system holds the motor speed constant within close limits, independent of load and ordinary line-voltage variations. An adjustment in the panel makes it possible to adjust the regulation to provide a drooping speed characteristic where this is desirable.

For a given speed setting, the equipment can be adjusted to hold the regulation to a value of approximately 2 per cent variation from no load to full load when operating below the basic motor speed. When the motor is operating in the field weakening range, the speed will decrease with load, to a value not exceeding 10 per cent depending upon the rating of the drive.

The close regulation provided with the system makes it possible to operate the motor on a constant torque basis below base speed at any speed within the stable operating range. This means that it is possible to get a motor to operate at some low speed such as 100 rpm, for example, and maintain this within close limits even though the load may vary from no load to full load.

For applications where a more precise speed regulation is desired than that obtained with the standard equipments, it is possible to use the output voltage of a tachometer generator in the circuit and obtain a speed regulation on the order of plus or minus ½ per cent from no load to full load. This arrangement provides exceptionally close regulation regardless of line voltage variation. Certain types of testing equipment often demand regulation of this low magnitude.

Effects of A-C Voltage Variation

The system will operate successfully on line-voltage variations of as much as 10 per cent of rated voltage, but to obtain maximum tube life the variation should not exceed plus or minus 5 per cent.

For a plus or minus 5 per cent line-voltage variation, tests have indicated that when operating over a range of from 5 per cent of base speed up to 2 to 1 by field control, the speed will not vary more than plus or minus 1 per cent.

One very important considera-

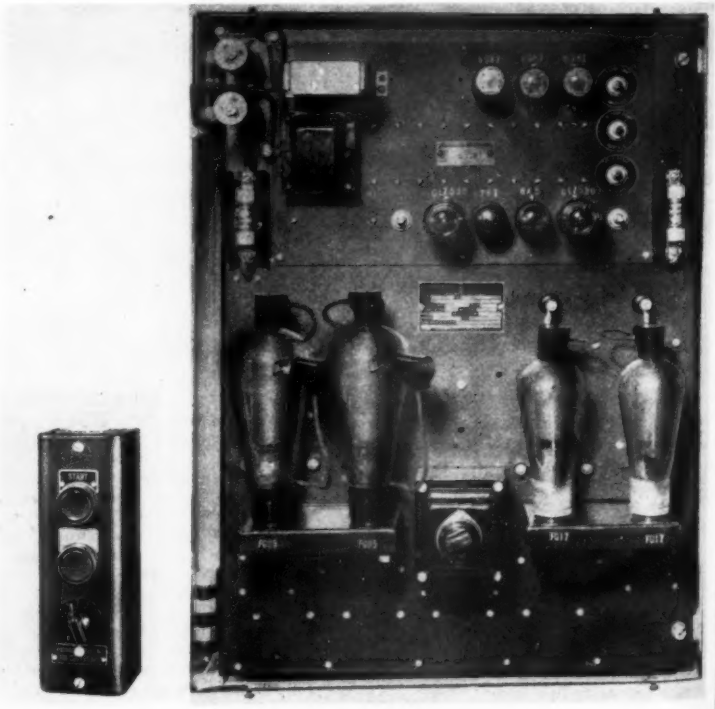


Fig. 2. Thy-mo-trol panel (right) and heavy-duty-type push-button station—these together with an anode transformer and a d-c driving motor comprise the standard Thy-mo-trol drive.

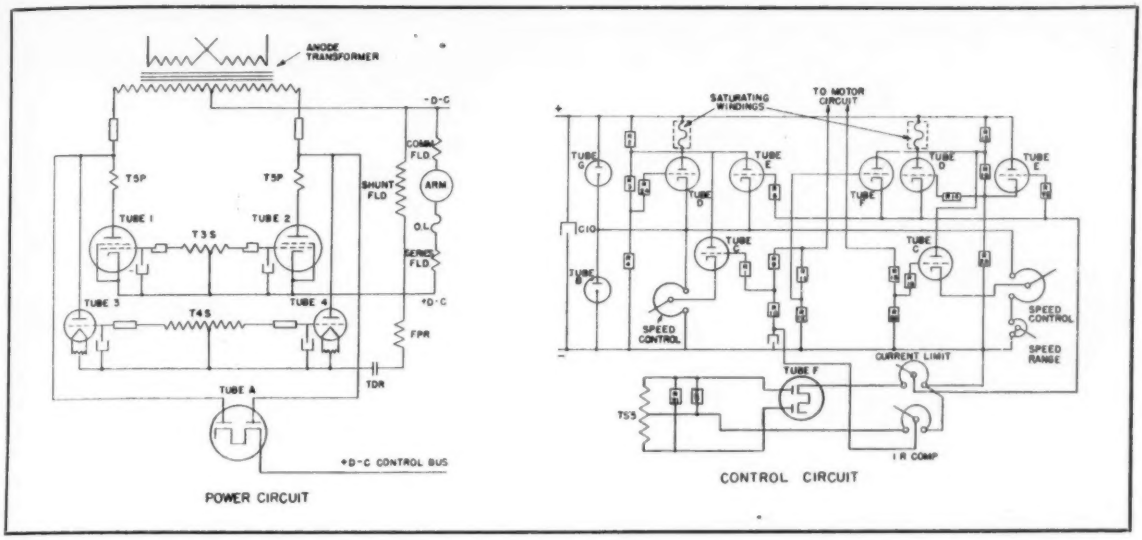


Fig. 3. Circuit diagram showing thyratron rectifiers connected to motor. Fig. 4. Elementary diagram showing control circuit.

tion with any electronic equipment is the question of what will happen if one or more of the tubes should fail. In this system, the circuits have been so designed that the equipment is entirely safe regardless of which tube or combination of tubes may fail. The equipment will either shut down instantly or will continue to operate, deprived of the function of the tube which fails.

All of the inductive circuits in the system which might be injured due to excessive voltage are protected by Thyrite units which keep the voltage rise down to safe limits.

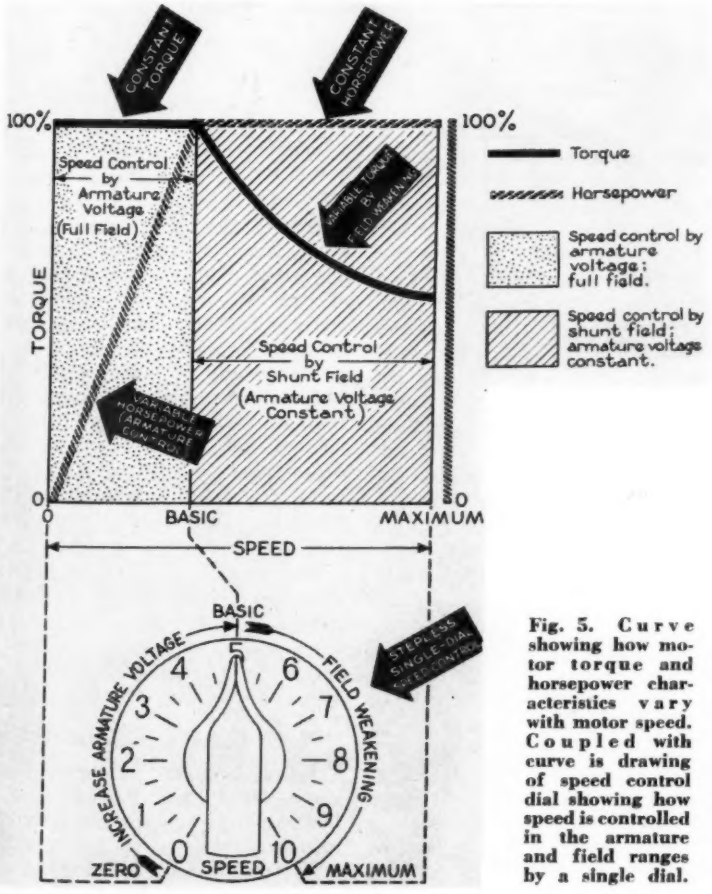


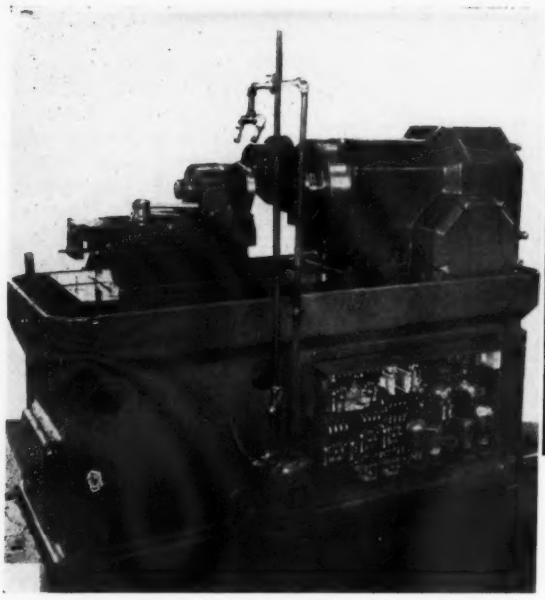
Fig. 5. Curve showing how motor torque and horsepower characteristics vary with motor speed. Coupled with curve is drawing of speed control dial showing how speed is controlled in the armature and field ranges by a single dial.

Principle of Operation

The operation of the equipment can best be understood by considering individually the part which makes up the power circuit and that which constitutes the control circuit.

From the diagram shown in Fig. 3 it can be seen that a pair of tubes (Tube 1 and Tube 2) constitutes a full-wave rectifier which converts to direct current the alternating current supplied by the anode transformer. The direct current is then fed through the armature of the motor. Likewise, Tube 3 and Tube 4 make up a full-wave rectifier, which supplies direct current to the shunt field of the motor. By varying the outputs of these two rectifiers, it is possible to control the operation of the motor. Its speed can be varied from zero, by armature-voltage control, up to maximum for which the particular motor is designed to operate by field weakening.

The means by which the output of the power rectifiers is varied is a group of radio-type control tubes,



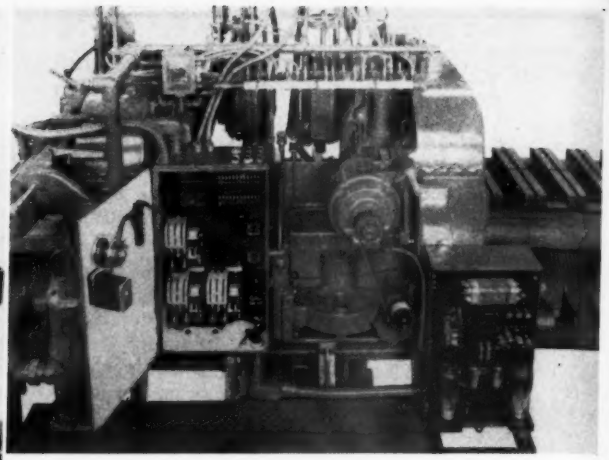


Fig. 6. (Left) Standard Thy-mo-trol panel (lower right) mounted on machine for milling airplane spars. Electronic control on this machine is used to control the d-c feed motor. The a-c magnetic control panel (left center) controls other operations. Fig. 7. (Above) Built-in application of Thy-mo-trol on milling machines.

whose basic circuit is shown in Fig. 4. Acting as amplifiers of current and voltage signals received from the motor circuit, these tubes supply the necessary direct current to the saturating winding of the saturable-core reactor in the resistance-reactance bridge which is used to vary the output voltage of the power rectifiers by the phase-shift method previously described. By varying the current in the saturating winding, the power tubes are turned on or off as required to give the desired motor performance.

To provide for the curent-limit acceleration of the motor, a current transformer, T5, is used. This has two primary windings connected in the anode circuit of the two power tubes supplying current to the motor armature. The design is such that an a-c voltage is produced in the secondary, proportional to the current flowing through the thyratron tubes. The a-c voltage is rectified and connected into the circuit in such a way that when it reaches a value as determined by the setting of a potentiometer, it will have the effect of turning off the armature tubes, thus reducing the voltage on the armature and maintaining the current at a fixed maximum value.

If the control had been set to operate the motor in the field-weakening range, the current-limit control acting through a suitable tube will maintain full field until the armature current starts to reduce. Thus, during acceleration under these conditions the motor will always accelerate from zero to base speed with full field. At this point, the field will be weakened gradually until the motor reaches the preset field weakened speed. Then the armature current will drop to the value necessary to drive the load.

How Speed Is Adjusted

The adjustment of the speed is controlled by two adjustable potentiometers—one controls armature voltage, the other controls field voltage. The potentiometers are operated from a single shaft and are arranged so that approximately half of the rotation of the adjusting knob will vary the armature voltage from approximately zero to maximum. Then the other potentiometer becomes effective, and further turning will tend to reduce the field voltage so that the motor speed can be increased to the value desired, up to the maximum for which the particular motor is designed to operate by field weakening.

To maintain accurately the preset speed, it is necessary to hold armature counter-emf constant. This can be done by increasing the armature terminal voltage by an amount equal to the IR drop of the armature circuit. In this system, this is accomplished through the use of the same current transformer that controls the current limit. The circuit functions in such a manner that as armature current increases, the thyratrons in the armature circuit are turned on, thus increasing the armature voltage. If the load increases, the circuit operates to increase the armature voltage proportionally, which thus acts to maintain the speed at its present level. An adjustable potentiometer used in the circuit makes it possible to maintain essentially constant speed from no load to full load for any given speed setting, or to provide a drooping speed characteristic where desirable.

When the start button is pressed, the motor will be accelerated rapidly and smoothly by current limit as described above until it reaches a speed corresponding to the setting of the speed-adjusting potentiometer. The motor will then maintain this speed closely, irrespective of variations in load, within the limits of the IR-drop-compensation feature. When the stop button is pressed, the anode contactor will be dropped out and a resistor will be connected across the armature to bring the motor to a quick stop as full field is applied.

The substitution of a magnetic-reversing switch for the anode contactor makes it possible to reverse quickly the direction of rotation by current-limit regeneration of the motor.

Motor Operating Characteristics

When the motor is operating at speeds below basic, during which it has full-field voltage and reduced-armature voltage, it will provide

(Continued on page 64)

Maintenance Service for Cooking and Baking Equipment

By Maynard F. Nagel*

WITH THE nation at war, *service* has a vital place in the march to *victory*.

One of the important classifications of service is that pertaining to the maintenance of food cooking and baking equipment. This article deals with commercial electric cooking and baking equipment as used in the Navy and Merchant Marine galleys, Army installations, hospitals, educational and state institutions, hotels, and restaurants.

The objective of every user of such equipment is continuous and uninterrupted satisfactory operation of equipment. Contributing to this objective are: (1) Correct installation, assembling and placing on location, proper line connections as to phase and voltage in accordance with instructions and wiring diagrams usually furnished. (2) A knowledge of the use and operation of the equipment. (3) Regular routine cleaning and inspection as a preventative service. (4) Ability to diagnose conditions and apply corrective adjustments or repairs.

Many conditions arising do not require mechanical or electrical repairs. A correction in installation, method of operation, or minor adjustment may be all that is needed. To catalog situations such as these, the accompanying chart offers a ready reference for analyzing conditions as reported or observed and the causes.

Since cooking or baking depends primarily on heat, a temperature control or thermostat is used to automatically control the degree of heat required, from a predetermined setting.

There are two types of controls in use: one consists of a helical coil or bimetallic blade that expands or contracts on heating or cooling. This action imparts a force to open or close contacts.

Fig. 1. Fry Kettle.

A later type and one currently used is a hydraulic actuated control. This consists of a bulb filled with a liquid which, on heating or cooling, expands or contracts, imparting pressures on a blade to open and close contacts.

Adjustment of helix type controls is accomplished by means of a set screw that works against the temperature indicating pointer.

Before adjusting or calibrating a bulb type control, too much emphasis cannot be placed on the importance of accurately checking the temperature. Where adjustments are made to compensate for temperature differences caused by external sources such as draughts, over-loading, etc., nothing has been accomplished and the control is then actually out of adjustment for normal conditions. It is important, therefore, to employ a reliable and accurate means for checking temperature. This is best accomplished with a thermocouple and millivoltmeter or similar instrument, and next best, with a good mercury thermometer. When checking temperatures be sure the oven, grid surface, or frying fat is thoroughly preheated.

To check temperature and adjust control of an oven, suspend thermocouple or place thermometer approximately in center of oven. Set control dial to 400 and

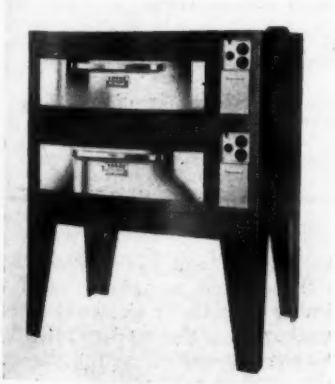


Fig. 2. Oven.

Fig. 3. Broiler.

Fig. 4. Range.

*Mr. Nagel is product service specialist for the Edison General Electric Appliance Co., Inc., of Chicago, Ill.

thoroughly pre-heat oven at that setting, keeping door and damper closed. Then turn switches to "off" and allow oven to "idle" for 10 minutes. At the end of 10 minutes, turn dial to left until contacts snap closed (an audible click indicates closing or opening of contacts within the control) note dial reading and then turn dial to right to open the contacts. The average dial reading between the closed and open contact positions indicates the control temperature setting. Check the actual oven temperature as recorded by the thermocouple or thermometer and compare with the average control dial value. Increase or decrease the temperature control value to agree with the actual temperature by recalibrating the control (see Fig. 5).

To adjust temperature control of fry kettles, follow procedure for ovens except preheat fat to 375 degrees F dial setting on control and check temperature at the center of the fat container and 2½ inches below the fat surface.

In the case of griddles follow the same procedure as for ovens except preheat to 400 degrees F dial setting on control and check temperature with thermocouple in globule of solder or thermometer bulb covered with fine sand at center of grid surface.

Repairing Commercial Equipment

While the means of accomplishing a needed repair or replacement of a part usually suggests itself, a knowledge of construction features are important to locate the source of trouble.

The word "unit" is generally accepted to mean the part or assembly that supplies the heat. These units, for the most part, are connected to a three-heat switch which permits obtaining a high, medium, or low heat. Each unit, therefore, has two separate coils or elements, both having the same voltage and wattage rating. On high, through the internal circuit of the switch, both coils or elements of the unit are placed in parallel across the line, thereby giving the full unit wattage; on medium, one coil is across the line, giving half the unit wattage; and on low, both coils are in series across the line, giving one-quarter of the total unit wattage. When checking a unit to make sure it is operating at its rated wattage, place an ammeter in series with the unit circuit and turn the switch through the three heat positions. The indicated ampere values should be in the same relation as the wattage ratings for the three positions. This check is especially helpful in connection with bake or roast oven units as these units are made up of a number of coils or elements wired together in series and parallel to give the same effect as the smaller units having two coils.

Loose connections at points

Analysis of Operating Complaints on Commercial Electric Cooking and Baking Equipment

(Assumes proper line voltage for equipment rating and no apparent inoperative or malfunctioning parts.)

Conditions Observed	*Causes*
Ovens	
Uneven browning of products from front to back	Decks or baking surface not level. Flue directly connected to outside stack or exhaust system (drawing out heat). Draught from open window or fan blowing into oven. Damper open too far. Top unit too far back (pull forward). Frequent opening of door. Burned-on accumulation around door opening and bottom, preventing door from closing. Door balance requires adjusting.
Uneven top and bottom color	Insufficient pre-heating. Unbalanced switch settings for top and bottom.
Spotty bottom color	Uneven pan bottoms. Mixed light and dark pans. Burnt spillage accumulation on deck.
Under or over baked products	Temperature setting too low or high. Too short or long time allotment.
Steaming around door	Damper not cracked sufficiently to permit steam to pass through flue.
Fry Kettles	
Smoking of fat	Old fat, no fresh replacement added. Requires straining. Fat level below unit level.
Over-soaked products	Too low temperature. Over-loading of basket—too large quantities at one time.
Foaming	Products too wet. Fat deteriorated or dirty. Requires straining and fresh fat additions daily.
Ranges, Broilers, Griddles	
Surface hotplates buckled or not level	Carbonized accumulation between plates and at ends.
Food sticking to griddle surface	Grid not properly seasoned, requires cleaning and reseasoning.
Uneven grid temperature	Check for draught or fan blowing over surface.
Broiler smokes	Accumulation on grid or drip pan.

where leads are connected to terminals or oxidized fuse clips are contributing factors in failure of circuits. All connections should be tight and checked on periodical inspections. Consistent burning out of fuses may be due to under fusing. However, because of the heat generated, the fuse clips themselves become oxidized or lose their temper and, even though fuses of sufficient capacity are later installed, the contact between fuse ferrule and clips may be such that local heating sets in with a result that fuses continue to fail with ultimate failure of the cut-out block.

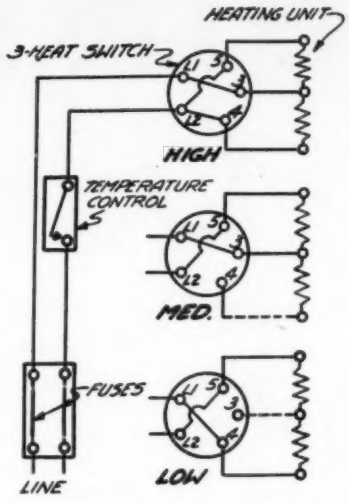


Fig. 6. Typical three-heat switch and unit circuit.

Loose or burned spring contact connections result in burning off of terminals on heating units, rendering them unusable even though the circuit within the unit itself is intact. It's always good policy to brighten up terminal connections or clips before installing new leads to insure good electrical contact.

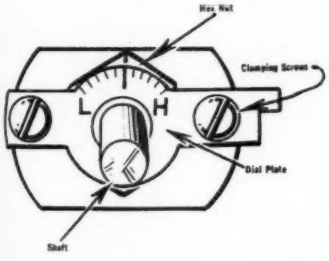
The units themselves should not be discarded as useless as in many cases a satisfactory terminal can be attached to the unit with an improvised connection that is tight, and satisfactory operation can be restored.

Successful handling of service requires a knowledge of the equipment as well as resourcefulness and ingenuity. Tracing down the source for inoperation discloses the source of the trouble. Unless the trouble is corrected permanently through satisfactory repairs or replacements no real service has been rendered.

Particular attention, today, must be given to the fact that it is no longer possible to draw parts "off the shelf" for immediate use and, therefore, every "trick of the trade" must be brought to bear in selecting the best method for accomplishing a repair.

The first approach to service is making an estimate of the situation. By process of elimination, the source of the trouble is located, and by manual skill the repair is completed.

Control with push-on dial knob:
1. **Pull dial knob off of shaft.**
2. **Loosen plate on back of knob.**
3. **Reset plate toward Raise or Lower.**
4. **Tighten plate and replace dial knob.**



Control with screw-on dial knob:
1. **Remove dial knob (pull out and turn left to unscrew from shaft).**
2. **Loosen two clamping screws on shaft dial plate.**
3. **Hold hex nut (back of dial plate) stationary and turn shaft to left to raise temperature and right to lower temperature.**
4. **Tighten clamping screws and replace dial knob.**

Fig. 5. To adjust actual temperature to agree with dial knob setting.

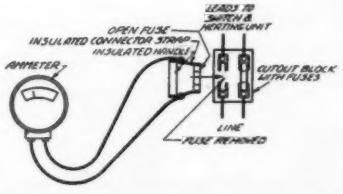


Fig. 7. Convenient unit circuit analyzer.

Tinned Funnel Saves Service Headache

"Owners of steam-electric pressing irons," says John L. Meyer, Jr., of Florida Appliance Service, Miami, Fla., "seldom have funnels for filling this type of iron."

Manufacturers of steam-electric irons furnish funnels, Meyer explains, but the latter usually are made from some plastic material, and are easily broken. If not broken, they become lost. Owners may buy small tinned funnels in hardware or dime stores but rarely, if ever, do so.

Instead, they replace water in their irons from a bottle or even at a faucet. Of course, this careless practice easily can result in a "short" and in a ruined heating element.

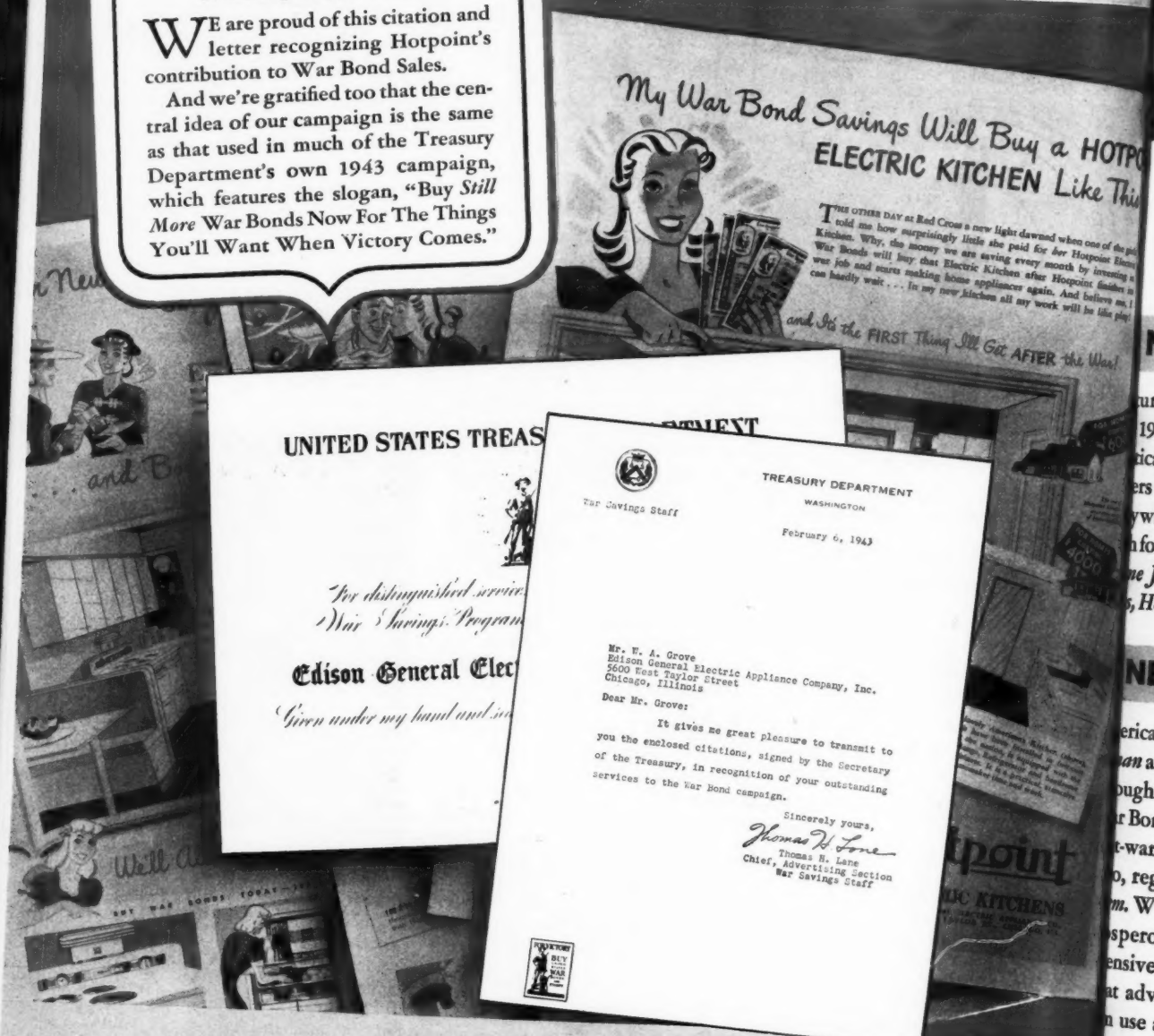
Therefore, Florida Appliance Service laid in a stock of tinned funnels, having a maximum opening at the top of about 3 inches. Thus, the firm has them available for its own use, and frequently sells one to a customer at a small profit. At the same time, he is told how improper filling may damage his iron.

HOTPOINT Cited for Wartime

Here Are Some of the Advertisements That Won the Citation from the Treasury Department

WE are proud of this citation and letter recognizing Hotpoint's contribution to War Bond Sales.

And we're gratified too that the central idea of our campaign is the same as that used in much of the Treasury Department's own 1943 campaign, which features the slogan, "Buy *Still More* War Bonds Now For The Things You'll Want When Victory Comes."


My War Bond Savings Will Buy a HOTPO
ELECTRIC KITCHEN Like This
THE OTHER DAY at Red Cross a new light dawned when one of the gir
told me how surprisingly little she paid for her Hotpoint Electric
Kitchen. Why, the money we are saving every month by investing
War Bonds will buy that Electric Kitchen after Hotpoint finishes
war job and starts making home appliances again. And believe me, I
can hardly wait . . . In my new kitchen all my work will be like play!
and It's the FIRST Thing I'll Get AFTER the War!
UNITED STATES TREAS
For distinguished service
War Savings Program
Edison General Elec
Given under my hand and
TREASURY DEPARTMENT
WASHINGTON
War Savings Staff
February 6, 1943
Mr. W. A. Grove
Edison General Electric Appliance Company, Inc.
5600 West Taylor Street
Chicago, Illinois
Dear Mr. Grove:
It gives me great pleasure to transmit to you the enclosed citations, signed by the Secretary of the Treasury, in recognition of your outstanding services to the War Bond campaign.
Sincerely yours,
Thomas H. Lane
Thomas H. Lane
Chief, Advertising Section
War Savings Staff
VICTORY BUY UNITED STATES WAR BONDS

REFRIGERATORS
RANGES
WATER HEATERS
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CLOTHES DRYERS
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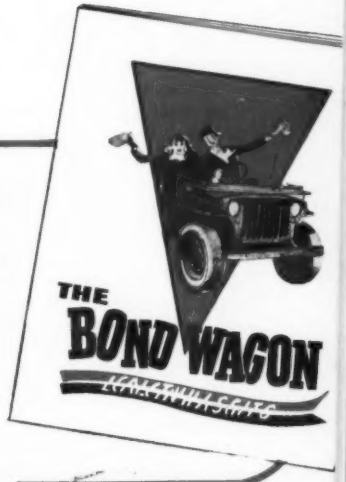
NATIONAL ADVERTISING

...urally, Hotpoint will follow up the success of ... 1942 advertising program which was so enthu... ...ically acclaimed by utility companies, large re... ...ers and official Washington. The program not ...y will be continued, but will be expanded in 1943, ...h four-color advertisements in *Life, Collier's, Ladies' ...e Journal, American Home, Better Homes & Gar...s, House Beautiful* and *Brides Magazine*—PLUS...

Use This New Wartime Promotion Program

STIMULATE War Bond Sales, and help yourself as well, with this new plan book. Full of ideas—for instance, the "Home Planning File", featured in Hotpoint's magazine advertising. Cooperate in this program. While it speeds Victory, it is building peacetime prosperity and employment.



NEW FARM ADVERTISING

...erica's two leading farm publications, *Country Gen...an* and *Farm Journal,* will carry special color pages ...ough 1943, to help support the Government's ...r Bond Program for farmers, and to help build a ...-war farm market for Hotpoint Electric Kitchens. ...o, regular pages will be used in *Electricity on the ...m.* When the war ends, American farmers will be ...sperous and *able* to buy. Because of Hotpoint's ...ensive program they will be familiar with the ...at advantages of Hotpoint Electric Kitchens for ...n use and be *willing* as well as *able* to buy them.

LOCAL ADVERTISING PLANS

For your own spring promotions, you will find this program made to order. The 1943 "Bond Wagon" Plan Book tells how to use Hotpoint's War Bond advertising theme in your own newspaper advertising and in customer contacts. See your Hotpoint distributor or factory representative. Edison General Electric Appliance Co., Inc., 5614 W. Taylor St., Chicago, Ill.

SCRAP
IS
POWER
YOU HELP
... the War Effort
... Your Customers
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... when you Salvage, in accordance with your Manufacturer's Instructions, all inoperative parts containing ...
CRITICAL MATERIALS
Cooperate with your industry! Put vitally needed scrap back into the Scrap TODAY!

...Electric Kitchens Tomorrow!

...LECTRIC KITCHENS

Servicing the Refrigerator

Part 3: Float Valves

THIS IS one of several articles on electrical refrigeration service based on the text "Simplified Training Course for Refrigerator Service Men" published by Nash-Kelvinator Corporation.

This course, described in ELECTRICAL SOUTH'S January issue, is Nash-Kelvinator's contribution to the impending manpower shortage with which the refrigeration service industry is faced.

IN PREVIOUS articles we have mentioned that float valves are used to control the flow of liquid refrigerant to evaporators or cooling coils. There are two general types of float valves used in household refrigerators: low side float valves, and high side float valves. They both derive the term "float valve" from the fact that they make use of the buoyance of a sealed metal ball to produce the acting force on the valve needle.

The classification of float valves into low side and high side types is determined from the side of the system in which the ball floats. The low side types float in the low pressure, low temperature liquid of the cooling coil. The high side types float in the high pressure liquid between the condenser and the cooling coil.

The low side type float valve is used to control the liquid level in flooded type evaporators. The float ball is located in the evaporator chamber where it is subjected to the pressure prevailing in the low side of the system, and is therefore called a low side float. The evaporator chamber of a flooded type low side is frequently called the "boiler."

Function of Low Side Float

The low side float feeds high pressure liquid into the evaporator through the valve seat orifice in direct proportion to the quantity of vapor removed from the evaporator by the compressor. The float ball floats in the liquid in the evaporator chamber. As some of the liquid absorbs heat, it vaporizes and the vapor is removed by the compressor. This causes the liquid level to drop and the float drops with it, opening the valve. More liquid refrigerant then enters the chamber from the liquid line and the float rises and either stops the flow of liquid or meters it in proportion to the demand and thereby maintains a constant level of liquid in the chamber.

A typical system is illustrated in Figure 1. The space or header for the float assembly is located at the top of the evaporator. A bolt circle and pad is provided to receive the float valve face plate with the attached float and needle assembly. Between the chamber bolt circle and the valve face plate is a composition lead gasket which forms a gas-tight joint.

In most designs, two service valves are provided and are attached to the valve face plate by gaskets and screws. The lower service valve is the liquid cut-off valve. A wire mesh strainer is placed between the service valve

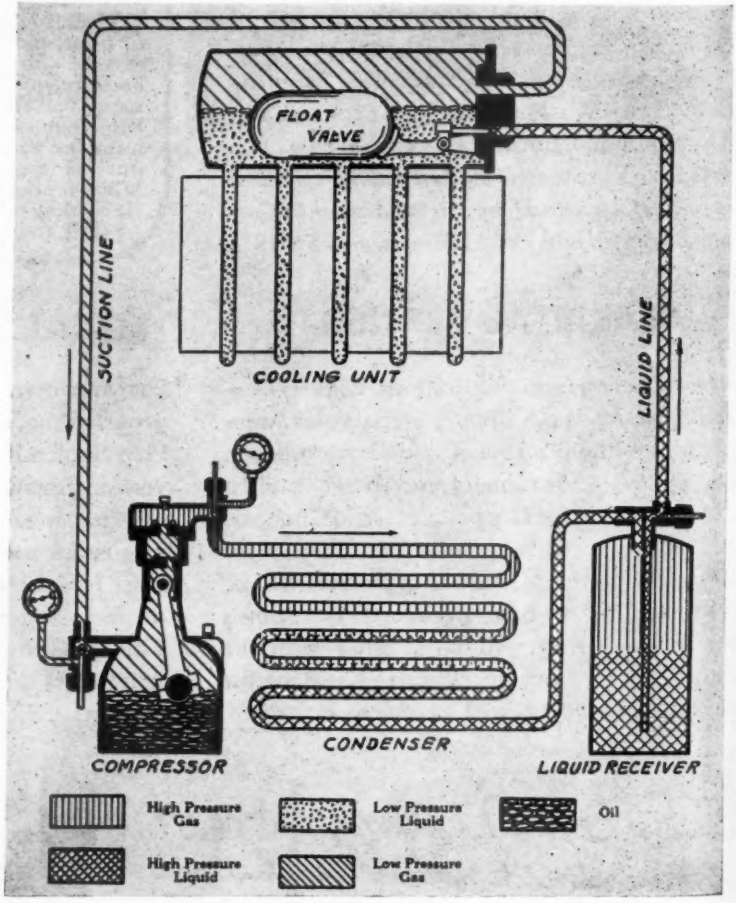


Fig. 1. A typical refrigerator system. The space or header for the float assembly is at the top of evaporator.

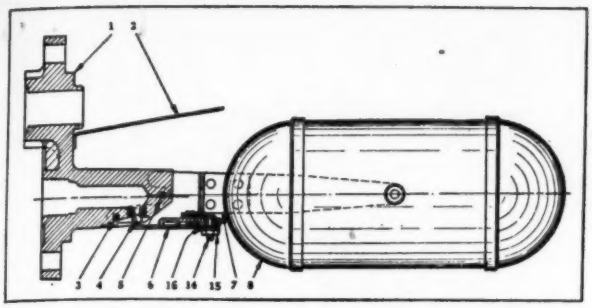


Fig. 2. Early type float using ball type valve.

(1) face plate, (2) baffle, (3) arm pin, (4) valve, (5) arm stop, (6) valve spring, (7) arm, (8) float ball, (14) valve spring screw, (15) spring screw nut, (16) washer.

and the valve seat to prevent foreign matter from injuring the needle valve and seat.

The float mechanism consists of a sealed metal float ball connected to an arm which in turn is connected to the valve needle and to a fulcrum which is either part of the face plate or is a bracket on the face plate. The top service valve is the suction cut-off valve. The opening from the top of the chamber through the face plate is frequently provided with a suction tube. An oil return hole is drilled in the suction tube so that the oil or liquid refrigerant level cannot become higher than this hole. One of the early type floats (illustrated in Figure 2) used a ball type valve.

The suction tube on the float shown in Figure 3 is soldered to the float face plate. This tube is a combination suction tube and baffle. The floats shown in Figures 2, 3, 4 and 5 are furnished with baffles. When replacing some floats it is necessary to solder the old suction tube in the replacement assembly. Some floats have the suction tube soldered to a thin face plate which fits underneath the suction service valve. Two gaskets are required for this type, one between the tube face and float face plate and the other between the tube face and service valve.

The float illustrated in Figure 6 is used only on small apartment house evaporators. No suction tube is required with the low capacity required from this type evaporator.

By following the cycle, Figure 1, you will note the compressor removes vapor through the suction tube, the liquid vaporizing by absorbing heat from the refrigerated space. The level of liquid is lowered allowing the ball to lower, opening the needle valve to the liquid line. An orifice and rate of flow is established into the evaporator equal to the rate of refrigerant removed by the compressor. When the compressor stops, evaporation ceases, the liquid level rises until the ball holds the needle against the seat.

Application of Low Side Floats

The low side float can be used in a single evaporator with a single condensing unit; in one or more evaporators connected in multiple with a single condensing unit; or in combination with other evaporators using thermostatic expansion valves with a single condensing unit. It should never be connected in multiple with other evaporators that use automatic expansion valves or a high side float liquid feed.

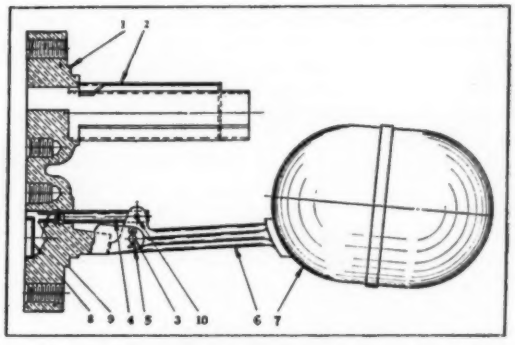


Fig. 3. The suction tube on the float shown here is soldered to the float face plate.

(1) face plate, (2) baffle, (3) arm pin, (4) valve, (5) arm stop, (6) arm, (7) float ball, (8) strainer, (9) valve seat, (10) valve pin.

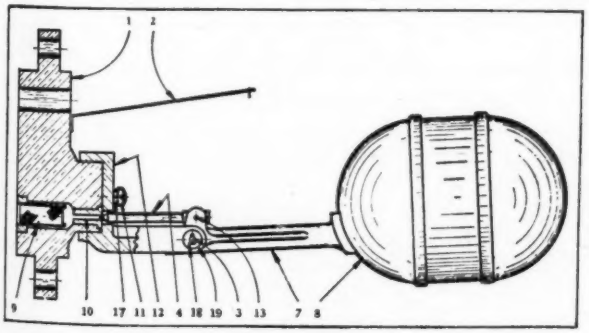


Fig. 4. Another type float with baffle.

(1) face plate, (2) baffle, (3) arm pin, (4) valve, (7) arm, (8) float, (9) strainer, (10) valve seat, (11) bracket screw, (12) bracket, (13) valve pin, (17) screw lock washer, (18) cotter pin, (19) pin washer.

The majority of low side floats are used on sulphur dioxide systems. They can, however, be used with methyl chloride or Freon-12 refrigerants if the buoyancy of the ball and orifice size is suitable for the particular refrigerant. The satisfactory use of low side floats with methyl chloride and Freon-12 refrigerants will depend upon the design of the evaporator, its loading, and the special precaution necessary to assure the return of oil from the evaporator.

The symptoms of low side float trouble come under the following

classifications. By checking over the cycle diagram, Figure 1, it is apparent that a shortage of refrigerant will cause the float to hold open, allowing the liquid to enter the low side continually as long as there is a difference in pressure. One of the indications of both a refrigerant shortage and a valve seat leak is a hissing noise at the valve needle. Refrigerant shortage will result in longer operation of the condensing unit and insufficient refrigeration.

If the float is leaking appreciably, a hissing noise will be present. A leaky float will raise the level in the evaporator during the off cycle and if the system is controlled by a low pressure control, may result in short cycles with frosted suction line due to a pull over of the surplus liquid. In order to determine if a valve is leaking or short of refrigerant, first check the refrigerant charge. If the charge is satisfactory, then it can be assumed that the float is leaking.

In many cases, foreign particles lodged on the float valve seat can be removed by shutting off the liquid line valve at the condensing unit and allowing the unit to operate for a few minutes, permitting the liquid level in the low side to lower and the needle to pull away from the seat. Then by opening up the liquid line valve as quickly as possible, liquid will rush through the needle seat and in many cases will carry away the foreign particles.

If foreign particles cannot be removed in this manner (by flushing out the needle seat a number of times), then the float should be changed.

A float ball may develop a leak and thus permit liquid refrigerant to enter the ball, reducing its buoyancy. This is not a common cause of inoperation. When it occurs, it results in a higher than normal liquid level in the evaporator. If the ball fills sufficiently, it will sink and hold the needle open. If the liquid level is raised slightly, the suction line will frost.

Clogged strainers may cause difficulty. A fine wire mesh strainer is located at the inlet to the seat. The strainer may be between the service valve and float face plate, or on early type floats it may be in the inlet service valve fitting. A partially clogged strainer will starve the evaporator. This means that mostly vapor will pass through the valve. With a pressure type control, short cycling and poor refrigeration will result; with a temperature control, continuous operation and poor refrigeration can be expected. Refrigerant entering the chamber in the form of vapor will aggravate oil logging of the evaporator.

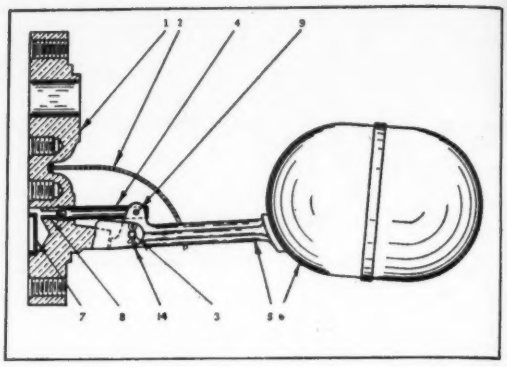


Fig. 5. Another typical float utilizing baffle type construction. See Fig. 6 for key to numbers.

Improper calibration for evaporator loading will result in improper operation. If the float cuts off at too low a liquid level, the oil blanket becomes too heavy, and an oil logged evaporator will result.

A characteristic that may be analyzed as float trouble is caused by liquid breaking up into vapor in the liquid line. This is usually caused by too small a liquid line, a liquid line passing through hot locations in combination with low condensing pressure, or pressure loss due to the vertical lift of the liquid. Any of these causes of vaporization in the liquid line will tend to starve the evaporator with its resultant troubles.

Float Calibration

Low side float calibration (liquid level adjustment) depends on several conditions. Factory calibration is standardized to check for liquid level with a fluid (orthodichlorobenzene) which approximates the specific gravity of the usual mixture of refrigerant and oil in the evaporator. The cut-off point of the float is set for average conditions of operation. Vapor bubbles rising through the liquid reduce the effective specific gravity of the fluid in proportions to the violence of evaporation. As a result the factory calibration may cause a frosted suction line on a poorly balanced evaporator and compressor combination.

An example of this condition is the use of a snap action valve in the suction lines on multiple systems. This type control may throw the capacity of a one horsepower condensing unit on a small evaporator. The large compressor capacity causes such violent evaporation that the float ball will sink due to lower density of the liquid. This is not improper calibration but poor application of the equipment.

Some of these poorly balanced installations may be improved from a service angle by providing a positive stop for the float travel to prevent the float from falling to the wide open position.

Float Repair

If the seat leaks or if the float is improperly calibrated, the float must be removed from the evaporator. To remove the float, pump the refrigerant out of the evap-

(Continued on page 63)

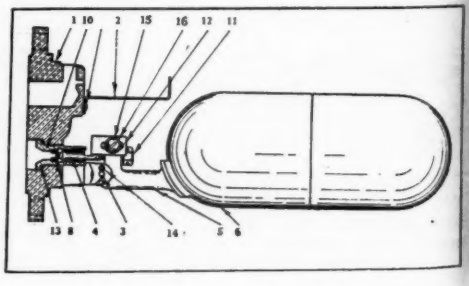
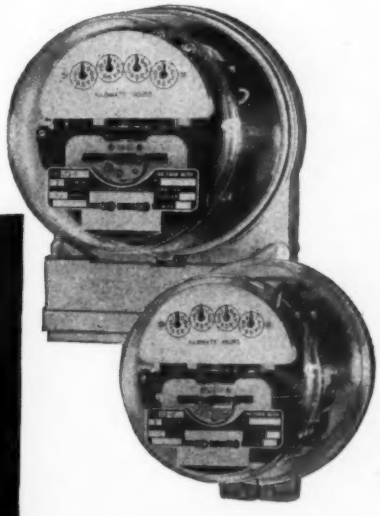


Fig. 6. This type float is used only on small apartment house evaporators. (1) face plate, (2) baffle, (3) arm pin, (4) valve, (5) arm, (6) float ball, (7) strainer, (8) valve seat, (9) valve pin, (10) valve cage, (11) adjusting screw, (12) valve pull-back, (13) valve cage gasket, (14) cotter pin, (15) pull-back screw, (16) screw washer.

WAR BONDS MAKE
UNCLE SAM MORE
POWER-*full*

ARMY E NAVY

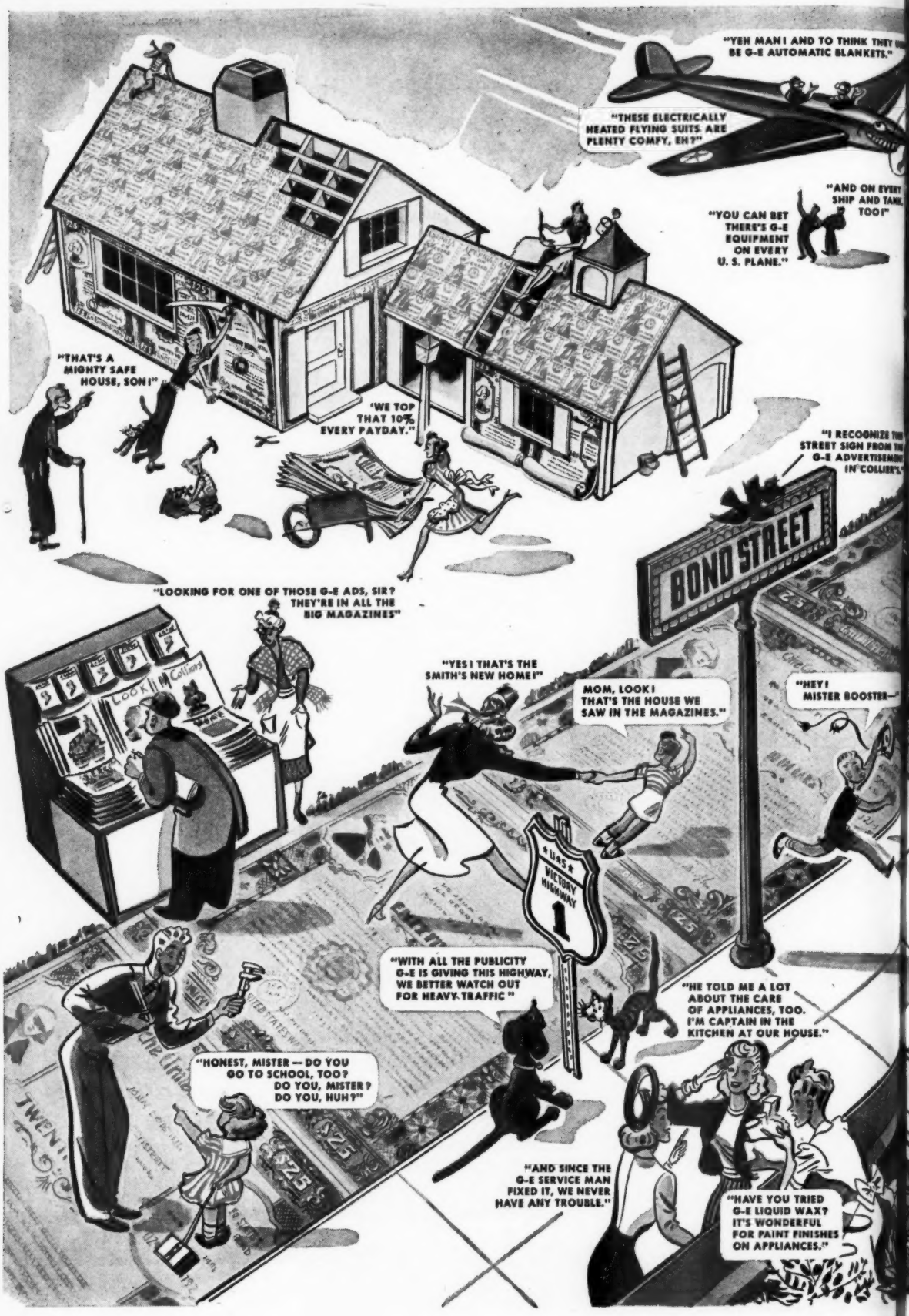


"On Measurement is founded the whole progress of man.."

At the beginning of the twelfth century in merrie old England, where would people turn for the acme of precision? Where, but to the king himself—and so Henry I made the "yard" uniform. There was only one king, so there could only be one yard. The distance from Henry's nose to the tip of his outstretched thumb became the lawful yard. Was the king in good humor and wholly relaxed on that day? Was he measured at dawn or at eventide? No one knows! Yet, that was the conception of standardization. Compare it with today's high standard of measurement of electricity set and met by the electric utilities and the manufacturers of watt-hour meters.

NO OTHER COMMODITY IS MEASURED SO *Accurately* AS ELECTRIC POWER

● SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS ●


"YEH MAN! AND TO THINK THEY USED TO BE G-E AUTOMATIC BLANKETS."
"THESE ELECTRICALLY HEATED FLYING SUITS ARE PLENTY COMFY, EH?"
"AND ON EVERY SHIP AND TANK, TOO!"
"YOU CAN BET THERE'S G-E EQUIPMENT ON EVERY U. S. PLANE."
"THAT'S A MIGHTY SAFE HOUSE, SON!"
"WE TOP THAT 10% EVERY PAYDAY."
"I RECOGNIZE THIS STREET SIGN FROM THE G-E ADVERTISEMENT IN COLLIER'S."
BOND STREET
"LOOKING FOR ONE OF THOSE G-E ADS, SIR? THEY'RE IN ALL THE BIG MAGAZINES"
Look
Colliers
"YES! THAT'S THE SMITH'S NEW HOME!"
MOM, LOOK! THAT'S THE HOUSE WE SAW IN THE MAGAZINES."
"HEY! MISTER BOOSTER—"
U.S. VICTORY HIGHWAY 1
"WITH ALL THE PUBLICITY G-E IS GIVING THIS HIGHWAY, WE BETTER WATCH OUT FOR HEAVY TRAFFIC"
"HE TOLD ME A LOT ABOUT THE CARE OF APPLIANCES, TOO. I'M CAPTAIN IN THE KITCHEN AT OUR HOUSE."
"HONEST, MISTER — DO YOU GO TO SCHOOL, TOO? DO YOU, MISTER? DO YOU, HUH?"
"AND SINCE THE G-E SERVICE MAN FIXED IT, WE NEVER HAVE ANY TROUBLE."
"HAVE YOU TRIED G-E LIQUID WAX? IT'S WONDERFUL FOR PAINT FINISHES ON APPLIANCES."

FOR INFORMATION ON Nutrition · Food Preparation · Appliance Care
Laundering · Automatic Heating · Food Preservation · Home Canning
Consumer Consultation · Appliance Repair · Air Conditioning
WRITE TO THE GENERAL ELECTRIC CONSUMERS INSTITUTE
BRIDGEPORT..... CONNECTICUT
"I MUST HURRY HOME! IT'S TIME FOR FRAZIER HUNT AND THE G-E NEWS."
DOUBLE FEATURE
GENERAL ELECTRIC Presents
INTO THE WRINGER & OUT
Also
DON'T BLAME IT ON THE OVEN
FREE to All G-E Appliance Retailers FREE
HOUSEWIVES INVITED
"EXTRA! CLEVELAND AND ST. LOUIS OPEN NEW G-E SERVICE CENTERS."
WAR BONDS will build and equip NEW VICTORY HOMES tomorrow
BOOSTER BROS.
GENERAL ELECTRIC
IF WE CAN'T SELL YOU NEW ONES... WE'LL FIX UP THE OLD ONES
WARTIME HELPS for Homemakers
U.S. MAIL
"MY WIFE SENT FOR SOME OF THESE BOOKLETS — AND SHE SAYS THEY SURE ARE HELPFUL."
"MINNIE GOT SOME TOO. SAYS G-E CONSUMERS INSTITUTE SURE KNOWS THE ANSWERS."
CONSUMERS INSTITUTE MAIL
"PROPER CARE OF ELECTRIC APPLIANCES IS JUST PLAIN HORSE SENSE!"
"I POSED FOR THIS ON MY LAST FURLOUGH."
"IT'S JUST LIKE YOU, JIM! AND EVERYBODY SAW IT IN LIFE AND THE POST MAGAZINES."
SCRAP is POWER
ROY CARLEY

Long Hours and Ingenuity Answer to Service Problem

LONG HOURS and imagination are the important factors injected into the appliance business of U. B. and Jack Ausbun, brothers, of Ausbun Appliance Co., General Electric dealers, in the West End section of Birmingham, Alabama. They couldn't get new appliances to sell in the usual volume, so they began selling used ones, including furniture; they couldn't get repair men, so they decided to do the work themselves even though it required considerable night work.

As a result, the Ausbun brothers are busier than they ever were in their lives and making more money. In fact, they had to take over an adjoining building to provide more room for the expanded stock of new and used merchandise.

"You see it was this way," said U. B. Ausbun, who has been selling appliances since 1927, "as long as we could get the new stuff, we sold it by the carloads—so fast, we didn't have time to do more than stack the trade-ins up and keep on selling. Then came the freeze on most new merchandise. That gave us time to begin reconditioning the old stuff, which, as we expected, sold about as fast as the new. In fact, customers all but took it away from us.

"It wasn't long before we were about out of used appliances, so we went into the market and began buying everything we could get at a price that would warrant resale at a profit after reconditioning. On some of these refrigerators, ranges, water heaters, and small appliances, we are making considerably more markup than we did on the new ones.

"You might say today that we are a glorified used furniture store with the emphasis of course on electrical appliances and the repair of them. We have just simply attuned our business to war conditions as I will explain.

"The war has brought about the greatest transition of families in our history. Families are being broken up as men go off to the war and new families are coming in on war jobs. That means a lot of buying and selling of furniture and appliances and we are simply acting as the middle man, bringing the seller and purchaser together.

"For instance, the other day we bought the complete furnishings of a fiveroom bungalow. It is true that we were interested chiefly in the kitchen appliances, but we took the furniture, too, as the man wanted to get rid of it. We have already sold enough items out of this collection to net a nice profit and still have a few items left to sell.

"In the beginning, we bought out several dealers who were going out of business. The utility turned over to us a quantity of demonstration appliances, and our local jobber, who has been most cooperative, let us rummage through his warehouse and pick up appliances which had been set back in the corner for one reason or another. We exhausted every source of supply, got the merchandise, reconditioned it and sold it. Now we are buying mostly from individuals who want to sell and selling to other individuals who want to buy.

"It is true we have had some new merchandise to sell all along. This especially includes radios and phonograph combinations, electric fans, including attic ventilator types, kit-

"Business end" of the Ausbun brothers' appliance service shop. They solved the serviceman shortage problem by going to work themselves.

POWER ON THE MOVE!

Bus Duct always ready for quick layout changes

A southern plant, chin-deep in war orders, needed power circuits for a new department —*in a hurry*. Schedules couldn't wait for delivery of new equipment. What to do?

Bus Duct solved the problem. A 200-foot run of 20 standard 10-foot sections was moved overnight from a less important department. It filled the gap — production went on.

One of the great advantages of Bus Duct is its adaptability to any manufacturing set-up.

Built in standard, interchangeable sections, it can be used and re-used, and represents a *minimum* use of critical materials consistent with sound engineering. Plugs for individual machines can be moved or added at will, or whole sections of duct can be shifted to new production layouts.

Great industries have gained precious weeks—even months—on vital war contracts by installing Bus Duct. They have saved countless man hours through *continuity* of operation. They have cut maintenance costs to the bone.

BUY MORE WAR BONDS • SALVAGE ALL SCRAP METAL

Send for descriptive Bulletin No. 427

BULLDOG
ELECTRIC PRODUCTS CO.
Detroit, Michigan

BullDog Electric Products of Canada, Ltd., Toronto, Ontario

Field Engineering Offices in All Principal Cities

MANUFACTURERS OF Vacu-Break Safety Switches, SafToFuse Panelboards, Circuit Master Breakers, Switchboards, Bus Duct Systems — FOR LIGHT AND POWER.

Front view of Ausbun Appliance Co., Birmingham.

chen cabinets and table appliances. We can still keep a pretty good show of gleaming white appliances up front, but of course we can't back it up with a complete stock.

"Service just naturally goes with a business in used appliances. We couldn't get a repair man for love or money, so we are doing it ourselves, although it takes some night work in order to keep sales and service both going. Besides reconditioning our own merchandise for resale, we handle repairs also for our customers. We will repair anything or have it done. Sometimes we call in a mechanic on a part-time, after-hours basis. It seems everybody decided all at once to have their pressing irons, toasters, percolators and radios fixed up from the amount of this business we get. We don't claim to be turning out factory jobs as far as the reconditioning of major appliances is concerned, yet when we took an old stove, dipped it in a cleaning solution to remove the grease, repainted it and dolled it up all over, the original owner came in and wanted to buy it back.

"It may be that that we have to take the parts off two old appliances to make one in a reconditioning job, especially in view of the shortage of some parts. But that is all right as it puts one appliance out of two back in service. We donate the balance to scrap. In fact, we had such a collection not long ago piled out in front of our store that the local newspaper took a picture of it.

"As already indicated, we have just naturally gravitated into the furniture business since we found it best to buy up a householder's entire stock in order to sell others. We also have taken on some new merchandise including linoleum, glassware, lamps and electric blankets.

"We have advertised some in the want ad columns of the newspapers and over the radio, but mostly in the 'wanted to buy' classification. Naturally we watch the 'articles for sale' column in the newspapers closely and there are not many items in the house furnishings line that we won't buy."

The Asbun brothers were not sure they had the proper answer to emergency conditions at first. In fact, when the freeze came they talked about closing up and joining the army of war workers. But the community needed a store like theirs, needed it badly, in fact, as is proved by the way in which people come in hunting for appliances or to have old ones repaired. And from a long range point of view, the Ausbun brothers figure they will be in the front seat when it comes to selling new, stream-lined appliances after the war.

Balance Sheet Analysis Discloses Business Bugs

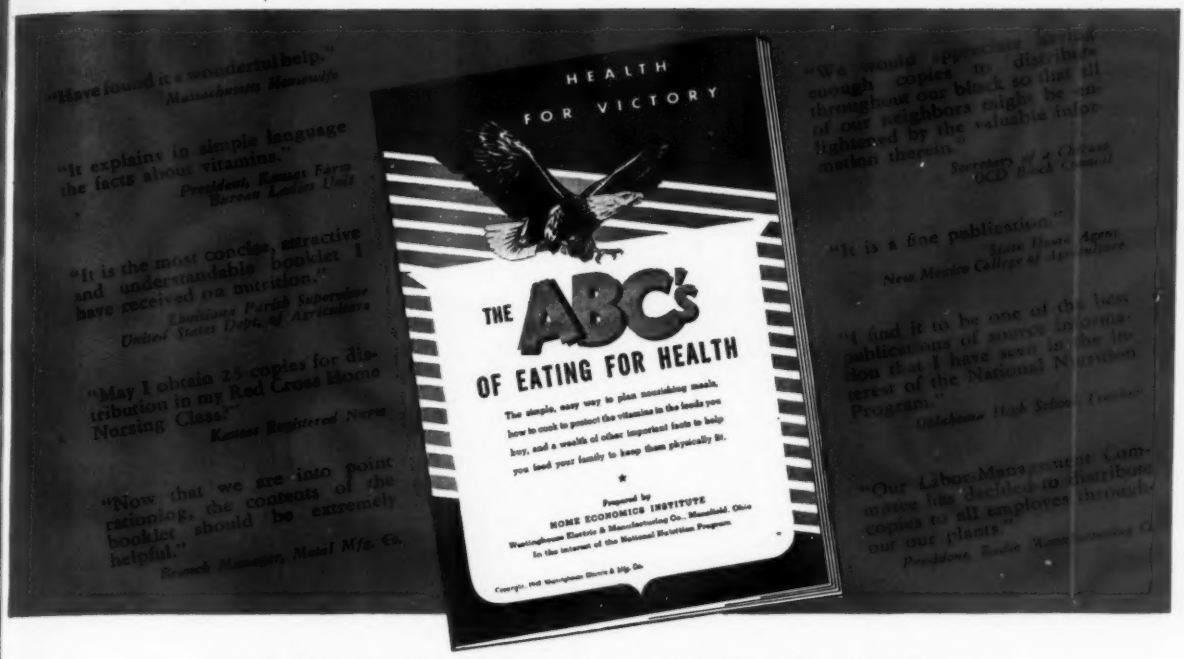
A HEALTHY looking net worth may belie the figures! It may be bloated by inaccuracies in other accounts and your business condition may need doctoring. Periodical balance sheet analysis is the preventive to keep the bugs out of your business system, to strengthen the weak spots and serve as a guide to the wholesome conduct of your establishment.

We cannot offer the exact prescription to remedy defects found through balance sheet analysis because businesses differ. The electrical contractor is the best doctor for the weak spots if he knows where to look for them. This monograph tells where to seek business ailments by a diagnosis of the financial statement. These suggestions and the specimen balance sheet will help you test your business blood pressure systematically.

Current assets — cash, receivables and inventory—are the life-blood of business. From this source, business procures the funds to carry on; hence, current assets should be liquid at all times.

A healthy cash account should run 15 to 20 per cent of current liabilities when current loans are no more than half the current liabilities, otherwise, the cash account should total more than 25 per cent of current liabilities. On the accompanying balance sheet of Fields and Jones, electrical contractors, the current loans of $4,000 are more than half the current liabilities, $7,145, hence, their cash should be more than 25 per cent of current liabilities. Cash is $1,575, current liabilities, $7,145, so they fall short on this ratio.

A ratio of current assets to current liabilities is called the current ratio and usually indicates adequate working capital if it is 2 to 1 or better. If the current ratio is less than 2 to 1, you may be using too much of current funds for fixed assets or buying too heavily on credit. Often the lack


"Have found it a wonderful help."
Massachusetts Housewife
"It explains in simple language the facts about vitamins."
President, Kansas Farm Bureau Ladies Unit
"It is the most concise, attractive and understandable booklet I have received on nutrition."
Louisiana Parish Supervisor United States Dept. of Agriculture
"May I obtain 25 copies for distribution in my Red Cross Home Nursing Class?"
Kansas Registered Nurse
"Now that we are into point rationing, the contents of the booklet should be extremely helpful."
Research Manager, Metal Mfg. Co.
HEALTH FOR VICTORY
THE ABC's OF EATING FOR HEALTH
The simple, easy way to plan nourishing meals, how to cook to protect the vitamins in the foods you buy, and a wealth of other important facts to help you feed your family to keep them physically fit.
Prepared by HOME ECONOMICS INSTITUTE Westinghouse Electric & Manufacturing Co., Mansfield, Ohio In the interest of the National Nutrition Program
Copyright, 1942 Westinghouse Electric & Mfg. Co.
"We would appreciate getting enough copies to distribute throughout our block so that all of our neighbors might be enlightened by the valuable information therein."
Secretary of a Civilian OCD Block Council
"It is a fine publication."
New Mexico Agent
New Mexico College of Agriculture
"I find it to be one of the best publications of source information that I have seen in the interest of the National Nutrition Program."
Oklahoma High School Teacher
"Our Labor-Management Committee has decided to distribute copies to all employes through our plants."
President, Radio Manufacturing Co.

Widely Publicized... Highly Praised

THIS WARTIME BOOKLET

will build customer good will NOW... for LATER

Next to the war itself, food is the big news these days. With one eye on their ration books and the other on crowded counters, people are clamoring for information about how to get the most out of their food dollars.

Homemakers, educators, women's clubs and consumer study groups have welcomed this booklet to help them on their wartime nutrition programs. Already, over one million copies have been distributed.

Retailers everywhere are helping give this vital 16-page booklet wider distribution. You can help—and gain good will for your store—by making it available to your employes and customers. Price in any quantity is only 1½c each. No charge for sample copies. Order from your Westinghouse Electric Appliance Distributor.

Talk about PULLING POWER

Every Westinghouse Health-for-Victory advertisement features "The ABC's of Eating for Health." These advertisements running in ten leading magazines are pulling anywhere from 1,200 to 6,000 requests per month. The fact that so many take the trouble to write proves how urgently people want this authoritative nutrition information.

Tune in John Charles Thomas every Sunday, over NBC, at 2:30 P. M., E.W.T.

of working capital is not noticed until credit is restricted or business dips deeply. The contractor who analyzes his balance sheet intelligently will ward off such dangerous complications. Fields and Jones' current ratio is better than 2 to 1, $15,225 in current assets to $7,145 in current liabilities. If the current liabilities exceed the current assets, there is a floating debt.

Cash and receivables are called cash assets. Try to keep cash assets in even ratio with accounts and loans payable. This balance sheet shows $10,175 cash assets to $6,850 payables, a ratio that gives a substantial margin of safety if the receivables, which are the largest portion of cash assets, are readily collectible. On too many contractors' statements, the receivables contain a percentage of delinquents and bad accounts and this weakens the ratio even though it appears substantial on paper.

How to Test Receivables

Test the collectivity of receivables. If notes receivable appear in a dominating position, it indicates a weak collection system. The contractor is probably taking notes in lieu of payments on open accounts. Set up a reserve for dubious receivables, otherwise, the net worth is inflated. How many week's business is tied up in receivables? Is the collection lag upward or downward? Compare receivables to credit sales for the current and previous periods to note the trend.

If delinquents are increasing, the greater the allowance for bad debts, the higher the current ratio. The electrical contractor should lean heavily on past experience as mirrored on previous balance sheets when making the current examination. For example, if credit sales for the past year were $18,000 and open accounts on the balance sheet are $4,500, the ratio is 4 to 1. If this ratio is satisfactory, and changes, find out why.

Obviously, if sales are made on 30-day terms, this ratio is bad because it shows that open accounts total three months' credit sales, at least two-thirds of which are past due. Keep a check on cash sales to receivables sales and total credit sales to average outstandings per month so that you can determine the trends in connection with your credit and collection procedure.

The rule-of-thumb computation that inventories should be 50 per cent, seldom more than 60 per cent of current assets, will not hold for the electrical contractor at a time like this or at any other time. This ratio is more applicable to the retailer. Normally, the inventories should never exceed the cash assets.

In this case, inventories are one-half the cash assets or one-third the current assets, rather an over-inventoried position for an electrical contractor but more justified than formerly because of the difficulty in getting materials and the natural tendency to stock up.

Nevertheless, if inventories are unduly high and current liabilities likewise, the business isn't functioning efficiently and needs immediate treatment. If inventories are a large part of current assets, the ratio of current assets to current liabilities should be greater than if inventories are a small portion of current assets because there is less confidence in the liquidity of inventories than in cash and receivables. If current assets are largely inventories, a business needs immediate check-over.

Fixed assets — buildings used for business purposes, tools and working equipment, fixtures and trucks—should be scaled down to conservative values. Some contractors carry fixed assets at purchase prices when they have depreciated considerably through the years of use. If no depreciation reserves have been set up for fixed assets, loss on inventory and receivables, the net worth may look good on paper but be anemic in reality.

Check fixed asset values conservatively. Appreciation of assets without good reason is bad business medicine. Fixed assets mean regular expenses for repairs, taxes, depreciation, hence, an adequate sales volume must be maintained to pay the toll. Divide the average of fixed assets into annual sales to get the turn on fixed investment. Check this turn with former years to note the trend.

Other assets — insurance and other items paid in advance, for which service has not been rendered — should be listed as deferred assets. Intangibles, such as good will and patents, should be carried at nominal values. Note

(Continued on page 62)

FIELDS and JONES, Electrical Contractor-Dealer
Financial statement or balance sheet
as of December 31, 1942.

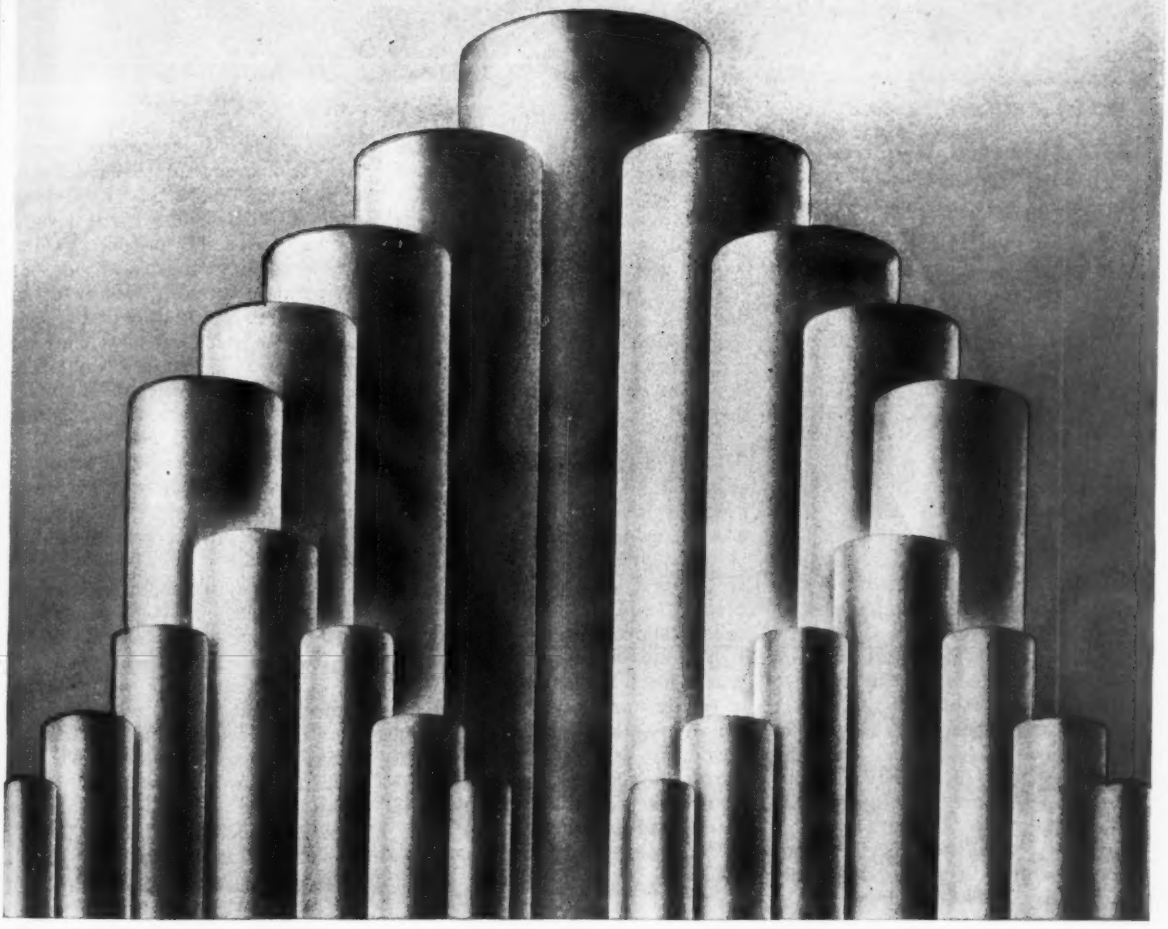
Assets

Cash on hand and in bank	$ 1,575	
Receivables, less allowances for bad debts	8,600	
Inventories at cost	5,050	
Total current assets		$15,225
Land and building for business purposes	24,750	
Tools and working equipment	2,500	
Office furniture and equipment	1,000	
Service trucks	2,000	
Total of fixed assets, less depreciation		$30,250
Goodwill	$ 1	
Deferred items	280	
Total of other assets		$ 281
Total of all assets		$45,756

Liabilities

Accounts payable	$ 2,850	
Loans payable	4,000	
Accrued items, including payroll, taxes, etc.	295	
Total current liabilities		$ 7,145
Mortgage payable—fixed liability		10,000
Total liabilities		$17,145
Net worth		$28,611
Total of liabilities and net worth		$45,756

In Tune with the Times



WALKER E.M.T. *Electric Metallic Tubing*

Now that steel is so precious—electrical contractors are turning to Walker E. M. T. (Electric Metallic Tubing) for their wartime installations.

Walker E. M. T. is available in three different finishes. One *completely sherardized*, inside and out; another with a *black enamel exterior* and a black enamel interior, and a third with an *electro-galvanized exterior* and a black enamel interior. There are six sizes—from ½ inch to two inch, inclusive; all furnished in 10-foot lengths.

Investigate! Get in touch with the local Walker distributor or write us direct. Walker Brothers, Conshohocken, Pa.

WALKER of Conshohocken

Manufacturers of: UNDERFLOOR DISTRIBUTION SYSTEMS; RIGID STEEL, FLEXIBLE AND THIN-WALL CONDUITS, RUBBER, RUBBER AND LEAD, AND SYNTHETIC WIRES AND CABLES; SERVICE ENTRANCE AND NON-METALLIC CABLES

PRACTICAL HELPS for the TRADE

Contractor - Dealer - Motor Shop

Close Motoring Requires Efficient Maintenance

Some years ago a survey was made to see how fully loaded industrial motors were and it was found that 80 per cent of the motors were underloaded. This came about by everyone wanting to play safe and it was a praise-worthy motive in ordinary times. The machinery manufacturer would decide that his motor required, let's say 12 hp. The standard sizes were 10 and 15 hp, so he would say let's play safe and put on a 15-hp motor. The chances are that if 12 hp ever was required it was only intermittent and the 10-hp motor would, in the vast majority of cases, have gotten away with the job.

We cannot afford that sort of engineering today. There just aren't enough materials to permit it. We are either going to have to do with less margins and factors of safety or we will have to do with less shells, guns, and other war machinery.

The electrical industry is urging that machines be more closely motored than they have been in the past; that the application engineer know more definitely what power a given machine will require and then apply the motor that will drive that machine, perhaps only for the duration of this war, whatever that may be.

Motors operating at reduced loads operate at poor power factors. The light-load motor efficiencies are not as good as those when motors are fully loaded. Both of these effects increase the current required to drive a given machine. Higher currents mean increased copper loss in the feeder cables and that loss goes up as the square of the current.

A more important consideration for us in these times is that if a 15-hp motor is used where a 10-hp motor could do the job the engineer responsible for the distribution cable layout has to use the 15-hp figure and put in larger feeders, thus wasting copper. Transformer capacities are usually based on some load factor applied to the total installed hp and the more overmotored the load is the further off is the transformer size selected.

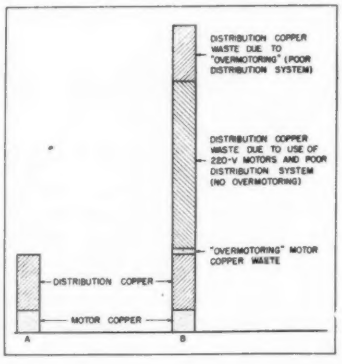
Another step in the right direction is to keep the secondary voltage as high as feasible. Any new installations of 220-volt motors should be out—we just can't afford them in materials.

To give you some idea of what is involved in this respect, approximately 5 lbs of copper per hp are used in the distribution system when a modern load-center system is used with 440-volts secondary. If 220-volt motors are used the copper required is doubled and runs to approximately 10 lbs per hp. If the old outdoor step-down station is used, feeder copper required is again approximately doubled, running as high as 20 lbs per hp. Obviously here is a very fine opportunity to save copper in new industrial plants or extensions by using good engineering.

The same considerations apply to industrial control where recommendations regarding means of saving critical materials have been made to WPB. Some of you do have the responsibility for selecting the size of motors for certain jobs, but my point in bringing this to the attention of the maintenance engineers is to point out how it affects your work. When a 15-hp motor was used on a 10-hp job one didn't have to be so careful about keeping it clean. It could get plugged up with dirt and oil and still have sufficient radiating capacity. In short, it didn't require as close attention as a motor which is operating right up to capacity.

With the overmotored machine the duty cycle could be stopped up without much consideration of the motor capacity. We cannot afford to put in materials today in the chance that next year or next month the work required of a machine may be increased. We have got to know what the job is and then motor according, and then keep production schedules within the capacities installed.

In short, this whole situation of critical material loads more responsibility upon the maintenance engineer — a responsibility to do his job better and a responsibility to assume a larger part in the production question in his plant, wherein production affects the load on the electrical apparatus.—*Excerpts from a talk by C. W. Fick, General Electric Company, before the Cleveland Electrical Maintenance Engineers' Association.*


DISTRIBUTION COPPER WASTE DUE TO "OVERMOTORING" (POOR DISTRIBUTION SYSTEM)
DISTRIBUTION COPPER WASTE DUE TO USE OF 220-V MOTORS AND POOR DISTRIBUTION SYSTEM (NO OVERMOTORING)
"OVERMOTORING" MOTOR COPPER WASTE
DISTRIBUTION COPPER
MOTOR COPPER
A
B

Bar chart showing (A) the amount of copper used in the motors and distribution system of a typical war plant with 440-volt motors (no overmotoring) and with a modern load-center distribution system, and (B) copper that would be used in the same plant if 220-volt motors, 25% too large, were used along with old fashioned distribution system bringing power to utilization points at low voltage.

Always Test Appliance Insulation After Repair

The insulation of any electrical appliance determines whether or not the appliance is safe to use. When a flat iron, heater or any appliance is sent to a repair shop to renew a flexible cord to repair a switch, before the device leaves the shop the insulation should be tested. Many inspectors, when re-

porting live frames of appliances, have been told by the users of some of the appliances that "it has just been in the repair shop for a new cord, new switch or some other replacement." The live frame of an appliance is a potential fire and accident hazard.

Determining Motor Load from Amperes

From Lynn W. Spray, electrical engineer for the Texas Gulf Sulphur Co., of Newgulf, Texas, comes the following interesting comment describing a method of determining the horsepower load on a motor by measuring the input current.

"The article by Mr. Joseph A. Setter, 'Determining Motor Loads from Ammeter Readings,' in the January, 1943, ELECTRICAL SOUTH was especially interesting to me. For the past twenty six years I have been using a very similar method with good success. The method described below was original with the writer, so far as known and, in fact, was incorporated in a thesis for a post graduate degree of Electrical Engineer at Purdue University, in 1921. When the test was first devised, it was checked with motor performance curves from the factory and found to be accurate within 5% or 6% up to 200% load, at least on the motors under consideration.

"Mr. Setter's methods is somewhat more accurate up to 50% of load but the variation of the method here described reduces to a simple slide rule calculation without the need of drawing or consulting curves and yet without sacrificing any vital accuracy. The same idea of measuring amperes per phase is used. Instead of breaking the curve at 50%, a theoretical straight line curve from 25% current, zero hp, to 100% current, 100 hp, is assumed. This full load current is read from the nameplate and 25% of it is assumed as average no load current.

"For example, assume a 75 hp, 220 volt, 3 phase motor rated at 196 amperes full load. No load is assumed to be 25% or 49 amperes. The 49 amperes is then subtracted from the actual load reading and also from rated full load. This is equivalent to moving the reference base of current upward to the zero hp starting point of the straight line to form a triangle. Horsepower then becomes proportional to current read minus 25%.

"Thus in the example cited, if the motor is drawing 175 amperes under load, the calculation is as follows:

196—49=147 amperes full load (above no-load current)

175—49=126 amperes running load (above no-load current)

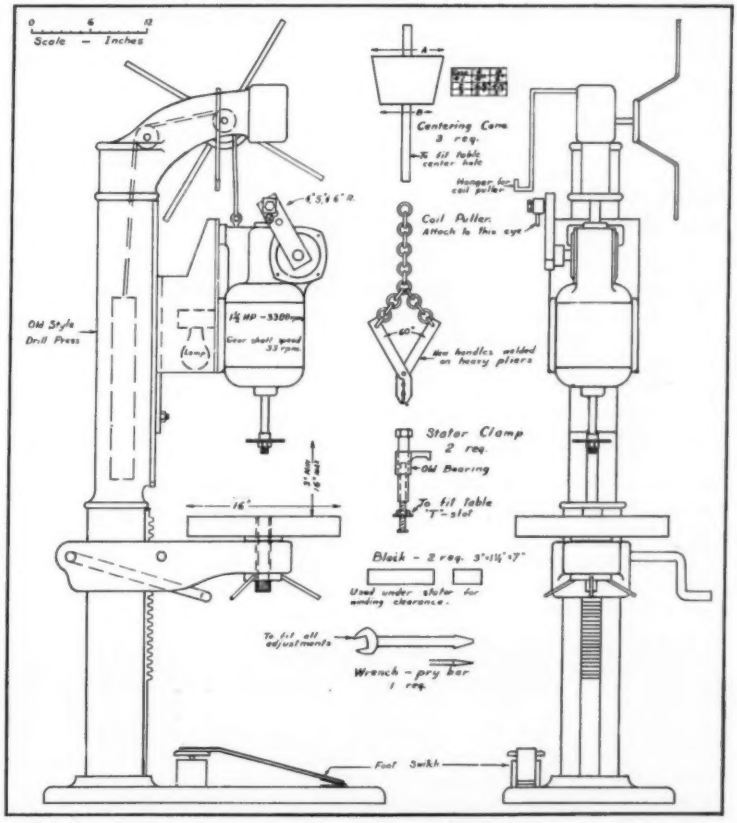
126/147=0.858 or 85.8% of full load=64.3 hp

"Mr. Setter's method obviously is more accurate in the range from zero to 50% or 60% of full load. But the critical range is when a motor is known to be somewhere nearly fully loaded, say 75% to 125% or more. In this range, either method, or readings from true curves would not be at variance by more than 2% or 3%—much less than that introduced by fluctuating load and voltage, not to mention ambient temperature.

"If a motor is operating around 25% load and a close reading is necessary, probably the most feasible thing to do would be to temporarily substitute a smaller motor operating near 100% and then use either of the methods to determine the load. An exact answer would have very little practical value. For instance, if a test of a 100 hp motor showed it 110% or 112% loaded according to the method of calculation, it would be a case of continuing to risk the 100 hp motor or install the next standard size, probably 125 hp.

"Mr. Setter's recommendation of a clamp-on ammeter is heartily endorsed. However, one may not be available and it may not be expedient to stop the motor to connect an ordinary ammeter. Before the days of clamp-on ammeters, we used to tap an ammeter—or primary of a current transformer if required—across the fuse of one phase and then pull the fuse to get a reading without stopping the motor.

"As stated above, the article was especially interesting in that others have tested and found useful the method that the writer for twenty-six years has used and considered accurate enough, within the limits of uncontrollable factors, for the practical case."



This stripper for small motors up to 5 horsepower will prove a useful addition to any motor repair shop. (Reproduced through the courtesy of the National Industrial Service Association.)

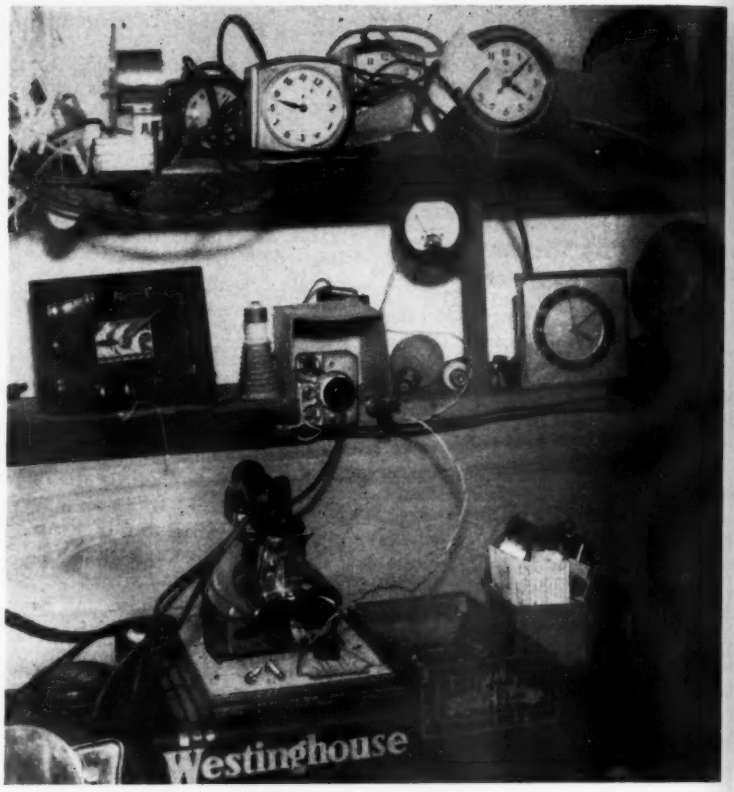
Thermo-Couple Testing Assures Accuracy

G. D. Marple, appliance service man of Miami, Fla., finds invaluable the use of a thermo-couple testing device for checking the temperatures of electric irons brought to him for repair.

The particular device he employs has a metal case provided with a plug-in outlet and a small test-lamp. A movable metal frame shaped to fit an electric iron rests on the base, and is attached by thermo-couple wires to a fractional volt-meter. For convenience in reading, the latter is fastened by a wood screw passing through a hole drilled in its flange to the outer edge of a shelf over Marple's work bench.

When an electric iron comes in for repair or temperature adjustment, Marple or his assistant sets it on the frame, and plugs the iron's cord into an outlet in the metal base. A cord from the latter to a "live" outlet supplies current. The test lamp in the base shows at once whether or not the iron is "dead".

If it is, the necessary repair is made. In any case, temperature adjustments are checked by the thermo-couple portion of the device. Incidentally, Marple made the contact point for this from a small silver coin.



G. D. Marple, appliance service specialist, Miami, Fla., considers thermo-couple testing device (left foreground) and fractional voltmeter (attached to upper shelf) indispensable for checking electric-iron temperatures.

Appliance Sales Space Now Record Department

Whether or not the aggressive merchandising of phonograph records will be the war-conditions solution to shortage problems of radio retailers remains to be seen—but if they are properly handled they can go a long way toward keeping the dealer in the same business or at least a closely related phase of it, according to J. A. Eberhardt, radio buyer for Maison Blanche, New Orleans, La.

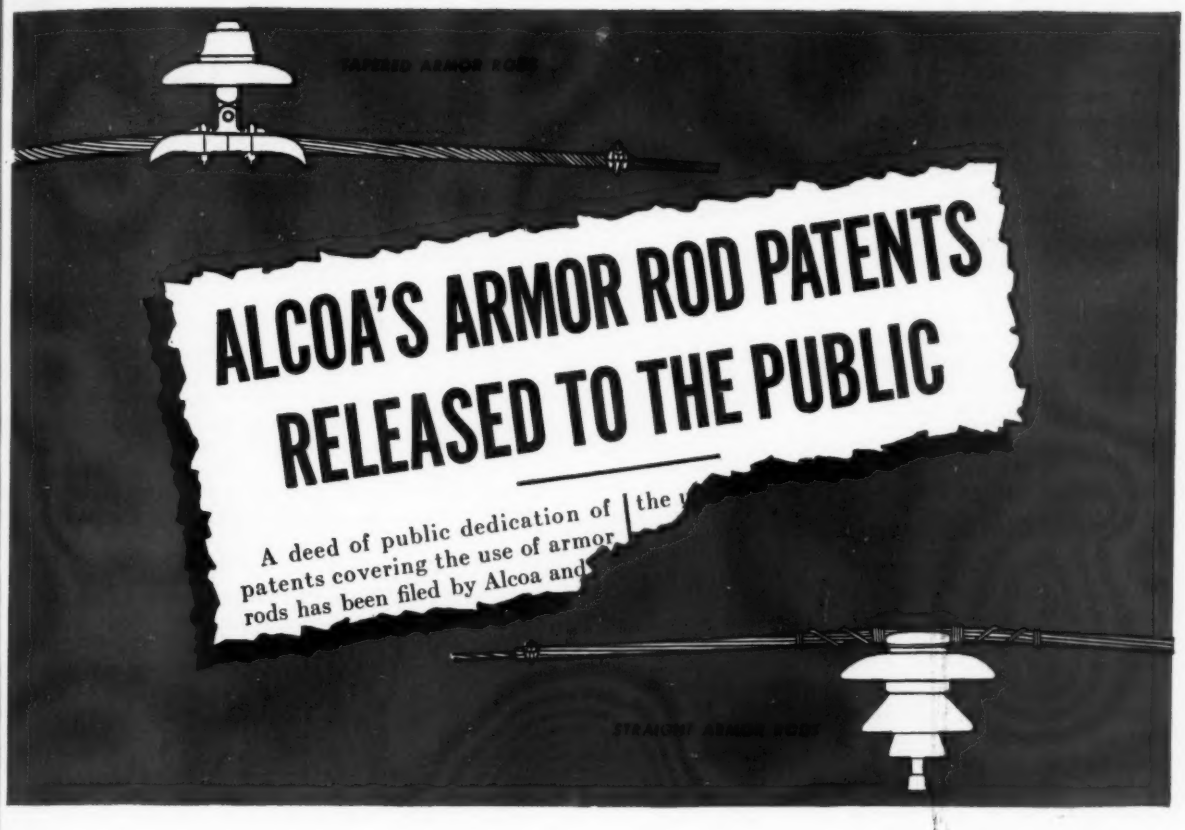
The Maison Blanche store recently converted its entire appliance department on the fourth floor into a huge record salon—including ten new record booths, a huge record stock counter, and an all-feminine sales staff. J. A. Eberhardt, radio buyer for the store, is endeavoring to keep his salesmen and the department operating and selling the same customers to whom it formerly sold more than 3,000 radios, phonographs and radio-phonograph combinations a year. The loss of this business by manufacturing curtailment, plus the loss of 1200 refrigerator sales a year was a bitter pill to swallow; but swallowed it was as Mr. Everhardt began planning to put the same good promotion behind phonographs records which built up the outstanding appliance sales volume.

"We think we can sell $5000 a month in phonograph records alone, plus whatever appliances and used appliances we can obtain," Mr. Everhardt stated. "Selling of phonograph records isn't vastly different from radio merchandising, since to a large extent the same customers are involved, but to bring them in requires just as outstanding advertising and promotion as to sell a top-ranking appliance volume. We think that the best bet for the duration of the war is to make phonograph records as attractive as possible to the most types of customers, to provide comfortable furnishings and surroundings for them while listening to sample records, and to carry a complete stock large enough to enable us to sell everybody no matter what he asks for."

All of these points are worked into the new phonograph record department. First, Mr. Eberhardt quadrupled the size of the former record stock, which had been more or less an "accommodation" business in connection with radio-phonograph combinations in the past. The Maison Blanche now has a record inventory which covers all aspects of popular, swing, semi-classical and classical music, and is stocked in a large 225x10 foot shop consisting of upright shelving enclosed by a continuous counter where radios were formerly shown.

Two regular saleswomen were appointed to run the record shop, both musicians and thoroughly trained on popular orchestras, stock system and salesmanship. Another girl, who comes in for the peak Saturday afternoon period, is also an accomplished musician—thus allowing Mr. Eberhardt to confidently and intelligently serve discriminating customers who want qualified advice on selections.

The former washing machine showroom was remodelled into ten compact, comfortable, record booths.


ALCOA'S ARMOR ROD PATENTS RELEASED TO THE PUBLIC
A deed of public dedication of
patents covering the use of armor
rods has been filed by Alcoa and

Desiring to serve the industry in the best possible way, we have released to the public patents covering the use of armor rods. This makes available to everyone, without the need for licensing procedure, a technique which, though originally developed for use with A.C.S.R., has since been employed on all kinds of conductors.

Armor rods resemble an extra layer of heavy strands covering the cable for a short distance each side of the insulators. Invented as protection against fatigue caused by resonant vibration, they increase the resisting moment of the cable at points of support. This distributes the stress due to bending, strengthens the cable at these critical points, and reduces its amplitude of vibration. The rods also protect the cable against burning by flashovers.

Most important right now, damaged conductors can be repaired with armor rods; thus often eliminating the need for new conductors. Where strands in a cable have been broken at an insulator, or burned by insulator breakdowns or flashovers, addition of armor rods usually makes the conductor "good as new." Alcoa engineers will gladly tell you how to employ armor rods on all kinds of power conductors. ALUMINUM COMPANY OF AMERICA, 2164 Gulf Building, Pittsburgh, Pennsylvania.

These measure 10x5 feet, five booths on each side, and are constructed of light fibreboard with the inexpensive pine lumber trim. They are soundproof and are each furnished with a new phonograph, two comfortable leather chairs, and a broadloom carpet. Innovations which aid their attraction are two shelves for customer's packages and records, ash trays on the walls to protect the carpet and woodwork, and finally, individual air conditioning provided by ducts off the main store system. "Nobody likes to sit in a hot, close atmosphere listening to records," Mr. Eberhardt pointed out.

Explanation of Code Amendments

Emergency conditions resulting from the war effort have led to the adoption of a number of Interim Amendments to the 1940 Edition of the National Electrical Code. Most of these amendments have been published in the form of a supplement to the 1940 Code and are now available. The Electrical Committee of the National Fire Protection Association has decided not to issue a 1943 revised edition of the Code but will keep the 1940 edition in effect, modified by these interim amendments.

In this and following issues of ELECTRICAL SOUTH, the most important amendments will be reproduced together with a brief explanation telling why each amendment was adopted and what its effect will be on wiring installations, etc. These explanations are *not* official interpretations but have been prepared especially for readers of this magazine by various members of the International Association of Electrical Inspectors, most of them members of the "Article Committee" concerned and men who played an important part in the preparation of the amendments which they explain.

(A copy of the 1940 Code and the Supplement will be mailed promptly upon receipt of 15c. Address orders to this magazine Grant Building, Atlanta, Ga.)

Interim Amendment No. 71

***Section 3205. Spacing. Interim Amendment No. 71. Approved August 4, 1942.**

Revise section 3205 to read:

3205. Spacing. Open conductors in dry places shall be separated 2½ inches from each other and ½-inch from the surface wired over. In damp or wet locations a separation of at least 1 inch from the surface wired over shall be maintained.

The effect of this amendment is to delete from the wording these words, "and for voltages 301-600 shall be separated four inches from each other and one inch from the surface wired oer."

Interim Amendment No. 41

***Section 3004. Temperature Limitations of Insulated Conductors. Interim Amendment No. 41. Approved February 26, 1942. Interim Amendment Nos. 63 and 66 Approved June 30, 1942.**

Insert a note to follow section 3004 to read:

For the duration of the defense emergency and to assist in the conservation of copper and rubber, conductors having Code grade rubber insulation that are not operated continuously with maximum currents may have the allowable current-carrying ratings that were given them in Table 1 of the 1937 edition of this Code and the limits of allowable current because of more than three conductors in a raceway (Note 5, page 303, 1940 text) and because of room temperature being over 30 C (Table 1, page 301, 1940 text) need not be applied.

"Continuous operation" as referred to in the preceding paragraph is operation where the load exceeds three consecutive hours or six non-consecutive hours at the maximum rating listed, during any 24-hour period.

NOTE: For Table 1 of the 1937 edition of the code, see tables in Chapter 10, pages 34S and 35S of this supplement.

For the duration of the emergency and to assist in the conservation of copper, conductors having varnished-cambric insulation (type V), or asbestos-varnished-cambric insulations (types AVA, AVB, and AVL), that are not operated continuously with maximum currents and are in raceways or cable assemblies, may have the allowable current-carrying ratings given in the table in Chapter 10 of this supplement; and the limits of allowable current because of more than three conductors in a raceway or cable (Note 5, page 303), and because of room temperature being over 30 C (Table 1, page 301), need not be applied. For single conductors in air, Table 2 shall apply.

NOTE: For the current-carrying capacities of types V, AVA, AVB, and AVL, see tables in Chapter 10, pages 34S and 35S of this supplement.

This amendment is self-explanatory and was adopted as an emergency procedure to be followed for the duration and providing for conservation of both copper and rubber. The effect is to place "Code Grade" wire under the current rating that was provided in Table I of the 1937 National Electrical Code and gives the conductors a considerably higher rating during the emergency than was provided for in the 1940 National Electrical Code.

Interim Amendment No. 35

***Section 3005. Types of Conductor Insulation. Interim Amendment No. 35. Approved February 26, 1941.**

Amend paragraph f of section 3005 to read:

f. Identification of Rubber Insulation. All single rubber-insulated fibrous-covered conductors No. 14 and larger shall have a readily identifiable permanent marking to indicate the grade of insulation, except that such marking need not be present when single conductors having code grade insulation are provided with a lead sheath.

This requirement does not apply to the individual conductors in multi-conductor, armored or non-metallic sheathed cables.

Single rubber-insulated fibrous-covered conductors having a lead sheath and all multi-conductor, armored and non-metallic sheathed cables containing rubber-insulated conductors shall be provided with a readily identifiable permanent marking to indicate the grade of insulation if such insulation is of other than code grade.

The effect of this amendment is to modify paragraph F of Section 2005 of the 1940 National Electrical Code so that the proper marking will be made for the duration and indicated on the wire identifying it. It only applies to the individual conductors and not to these conductors when utilized in multiple assemblies such as Armored or Non-Metallic Sheathed Cable.

Interim Amendment No. 44

***Section 3005. Types of Conductor Insulation. Interim Amendment No. 44. Approved April 9, 1942, revised June 30, 1942 and August 4, 1942.**

Insert the following fine-print note following the table in section 3005:

To assist in conserving rubber and for the duration of the emergency, on alternating-current systems, slow-burning weatherproof conductors (type SBW), weatherproof conductors (type WP), emergency insulated conductors (type EI), or other type specially approved for the conditions, may be used as the grounded conductor in any of the wiring methods of Articles 320 to 364 inclusive of this chapter.

The intent here is to provide for the use of other than rubber insulation on conductors (not including Slow-Burning Weatherproof or Weatherproof) when such conductors are employed on alternating current systems for the grounded leg only. The rule permits the use of special insulation such as the new EI insulated wire and cable used under limited conditions only, such as open knob-and-tube work or Non-Metallic Sheathed Cable when run exposed.

Interim Amendment No. 46

***Section 3005. Types of Conductor Insulation. Interim Amendment No. 46. Approved May 7, 1942.**

Insert the following fine-print notes following the tables in section 3005:

For the duration of the war emergency conductors having 90 per cent unmilled, grainless rubber insulation (type RU) and conductors having flame-retardant, moisture-resistant solid synthetic insulation (type SN) may be used wherever types R, RP and RH rubber-insulated conductors are acceptable.

For the duration of the war emergency type RU conductors in size Nos. 14 to 10 inclusive and type SN conductors in size Nos. 14 to 8 inclusive, when used for new work in raceways, shall be installed in accordance with table 6 on page 308. Type SN conductors in size Nos. 6 to 4/0 inclusive, when used for new work in raceways, shall be installed in accordance with table 4 as amended.

Provision is made in this amendment for conditions lasting the duration of the war emergency. The 1940 National Electrical Code placed certain restriction on both RU and SN wire. These restrictions applied both as to wire sizes and as to location of conductors. Under this amendment it is permissible to use both SN and RU wires having flame-retardant and moisture-resistant coverings or insulations in place of Type R, RP, or RH conductors. In other words, the RU and SN wires can be used in both old and new work.

Also, for the duration type RU conductors in Size 14-10 and Type SN conductors in sizes 14-8 when used for new work in raceways must be installed in accordance with Table 6 on page 308. Type SN conductors in Sizes 6-4/0 when used for new work in raceways shall be installed in accordance with Table 4 as amended.

Interim Amendment No. 64

***Section 3005. Types of Conductor Insulation. Interim Amendment No. 64. Approved June 30, 1942.**

In the table on page 87, opposite "Slow-burning" and, "Slow-burning weatherproof," in the fourth column under "Other limitations," delete the words "where room temperature exceeds 85C (185F)," so that the two notes will read: "For use only in dry locations."

NOTE: See also Interim Amendments (No. 64) to paragraph a of section 3005 and to paragraph d of section 93001.

The effect of this amendment is to limit the use to dry locations only. The effect of this amendment was also to nullify Interim Amendment No. 45 so that Section 3203 of the Code remains as it now appears in the 1940 edition of the Code.

New Electrical Books

Transients in Linear Systems — Volume I

By Murray F. Gardner and John L. Barnes. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York City, N. Y. 389 pages, illustrated. Price, $5.00.

The objectives of the authors of this book are two-fold: to provide a suitable text for first-year graduate work in electrical and mechanical engineering and in mathematical physics; and to provide a suitable reference book for practicing electrical and mechanical engineers and industrial physicists, making available to them recently developed mathematical theorems.

The text provides a practical presentation of advance mathematical methods for handling not only ordinary integrodifferential equations but also difference and partial differential equations. It introduces the reader to the Laplace Transformation. The treatment enables engineers to solve many problems by an effective and reliable method and yet avoid the quagmire of complex integration.

Of particular interest is Chapter II which deals with the mathematical expression of problems concerning lumped-parameter electrical and mechanical systems. The chapter analyzes the elements that make up electrical and mechanical networks. It shows convenient choices of variables and systematic ways of setting up the differential equations as well as expressing the initial conditions. A supplementary objective of the chapter is to point out the basis of "analogs."

Electrical Fundamentals of Communication

By Arthur L. Albert. Published by McGraw-Hill Book Company, 330 West 42nd Street, New York City, N. Y. 350 pages, 359 illustrations. Price, $3.50.

This book presents the electrical fundamentals upon which communication, including the three divisions of telegraphy, telephony and radio, is based. The book is especially adapted for self-teaching and provides a summary of the most important points at the conclusion of each chapter as well as a list of review questions and problems.

A special feature of the book is the presentation of elementary electrical theory in language, illustrations, and applications familiar to the radio man, the telegrapher, and the telephony engineer. It presents the fundamentals of electrical engineering, accurately, from the point of view of the communications industry instead of from the power industry as is done in some such texts.

Interior Electric Wiring and Estimating

By Uhl-Nelson-Dunlap. Published by the American Technical Society, Drexel Avenue at 58th Street, Chicago, Illinois. 354 pages, illustrated. Price, $2.00.

Third edition of this popular book, this new publication has been completely revised in accordance with the newest National Electrical Code, the 1940 edition. Over 50 pages of new material have been added, and, in addition, all the illustrative problems have been gone over and revised to comply with the new Code.

A new section on cable wiring has been written particularly with the apprentice in mind. These instructions include the wiring and installation of outlets in old houses in which wiring was never installed.

New drawings have been prepared to show the construction of houses, how floor boards can be removed, how the floor joists are bored, etc. In addition to general instructions on interior electrical wiring, the book includes special chapters on the wiring of apartment buildings, factory buildings, and the fundamentals of electrical estimating. In connection with the latter, eight full-sized blueprints are supplied in a pocket fastened to the inside back cover.

Air Conditioning Analysis

By William Goodman. Published by The MacMillan Company, 60 Fifth Avenue, New York City, N. Y. 455 pages, illustrated. Price, $6.00.

William Goodman, of the Trane Company, well-known to the air conditioning industry, points out in the preface of this new book that although such elements of air conditioning as refrigeration, air handling, and temperature control, have been treated extensively in numerous texts, the science of changing the condition of the air itself has not heretofore received in one place a comprehensive, unified treatment of its fundamentals. To provide such a treatment is the aim of this book, and the author has achieved this aim admirably.

The book has many outstanding features. The psychrometric chart is discussed in detail and the solution of the many types of air conditioning problems likely to be encountered in practical work are illustrated on it. As in his previous books, Mr. Goodman expresses the opinion that it seems more logical to use the term percentage humidity which is based on weight of air, rather than relative humidity which is based on volume of air. While both terms are discussed, the percentage humidity term is used in most of the problems. All equations and formulas throughout the book are derived at the end of each chapter where they do not interfere with the smooth development of the subject matter in the text.

A complete set of tables of the properties of humid air for all barometric pressures from 22 to 32 inches of mercury is given in this book as well as a table for the standard pressure of 29.92 inches of mercury. These tables are based on the latest steam tables, those of Keenan and Keyes. There are many places where the normal barometric pressure differs from the commonly assumed standard barometric pressure and, if accurate results are to be obtained in testwork, the properties of humid air at the actual barometic pressure existing during tests should be used.

How to Read Electrical Blueprints

By G. M. Heine and Carl H. Dunlap. Published by the American Technical Society, Drexel Avenue at 58th Street, Chicago, Illinois. 318 pages, illustrated. Price, $3.00.

Because of the diversified character of the work performed and machinery used in the various branches of the electrical industry, this text has been written in sections, each of which introduces the symbols used in a particular branch of the electrical industry. For example, one section explains how to read blueprints for wiring buildings, another for diagrams of motors and generators, another for electrical control diagrams, etc. The sections are arranged so that simple blueprints and diagrams are explained first and the more difficult ones last.

A new method of presenting the symbols has been introduced: pages of symbols have been prepared in which are shown pictures of the objects opposite the symbols which represent them. Anyone not familiar with a symbol can discover its meaning by a glance at the symbol and picture. This text teaches the student to visualize the object when he sees its symbol on a blueprint. Fundamental circuits have been chosen for explanation and considerable space has been devoted to explaining their operation.

Special feature of this book is a set of nine full-sized blueprints drawn to scale which may be kept in the pocket provided in the inside back cover. Another special feature is the set of questions and answers, more than 200 in all, which are provided at the end of each section.

Another "Power" the Axis forgot...

OUR POWER MAKERS

whose electrical output is the Lifeblood of War Production

IF you haven't already done so, Herr Hitler, you had better scrap your intuition. For in your carefully laid plans for world conquest, it has failed you once more. It has failed to warn you of a "Power" more formidable than any you have yet faced. That "Power", Herr Hitler, is *electric power*, American electric power, the power behind American production—the power that has met and will continue to meet every demand from our American factories geared to relentless war for Victory.

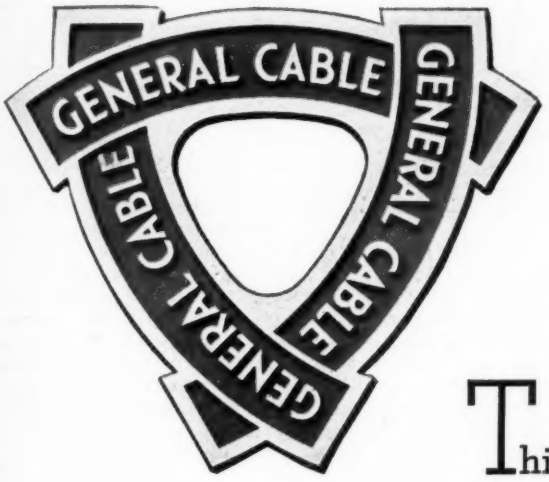
Electric Power has now become the yardstick of a nation's capacity for war. Here in America ours is almost limitless; thanks to the foresight of our power makers, the supply of electrical energy has always paced demand. It is not an accident that every war plant in America that needed more electric power got it when and where it was needed.

Forward planning has always been a characteristic of the utility industry. It has never waited until a demand for power developed. Theirs has been the job of anticipating demand and being "Johnny-on-the-spot" with adequate facilities so that when a switch was thrown, there was power available in the quantity needed. That is why America's war producing machinery went into high gear so soon. That is why the "Power" Hitler forgot is now making itself felt on all fronts, and will continue to increase into a mighty crescendo of thundering tanks, planes, guns and ships to overwhelm and completely destroy the evil forces that would enslave us.

GENERAL CABLE
CORPORATION

MANUFACTURERS OF BARE AND INSULATED WIRES AND CABLES FOR EVERY ELECTRICAL PURPOSE

G E N E R A L C A B L E



This General Cable message recently appeared in the country's leading influential newspapers. This and previous messages have been planned and timed to impress on the thinking people of America the vital role the Utility Industry is playing in the war effort, to the end that they do not overlook or forget in the years ahead the job you are doing and what "you've got to have" to do it.

☆ **General Cable Corporation Sales Offices:** Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Kansas City (Mo.), Los Angeles, New York, Philadelphia, Pittsburgh, Rome (N.Y.), St. Louis, San Francisco, Seattle, Washington (D.C.)

C O R P O R A T I O N

NEWS of the INDUSTRY
National and Southern

Bomber Building Program Progresses

Gathering momentum daily, the Bomber Builders Program of General Electric Lamp Department, is now zooming toward its ultimate goal of 600 million man-hours added anually as a direct result of smashing lighting bottlenecks along the industrial front.

Three-hundred-and-sixty-four big bombers, or the equivalent in other weapons of war, are being produced annually through the better illumination created by the efforts of "Bomber Builders."

Nearly 300 craftsmen who took the program pledge have each added the equivalent of 100,000 man-hours annually, the amount of time required to build one of the biggest fighting aircraft. Among these men wearing the coveted gold bomber award are 26 whose efforts are particularly outstanding. These 26 have broken so many lighting bottlenecks that production has been increased sufficiently to build at least five big bombers each year per man.

Most recent Bomber Builder news from the South comes from the Houston Lighting and Power Company, Houston, Texas, where dedication ceremonies were held recently for the christening of three bombers.

At a meeting held in Houston, F. M. Austin, vice president in charge of sales, of Houston Lighting and Power Company, had the honor of christening Bomber No. 1 which was "constructed" by the Wartime Lighting Counselors of his company. Mr. Austin christened his bomber the "Hitler Clipper" and in so doing pasted a sticker on the fuselage of the bomber chart. The sticker had an appropriate caricature of Hitler being clipped.

Fred Staacke, general commercial superintendent, had the honor of christening the second bomber, which he named the "Mussolini Muzzler," and in so doing, he used appropriate remarks in describing Mussolini.

P. H. Robinson, superintendent of industrial sales, christened the third bomber "Tojo Exterminator."

Already, Houston Lighting and Power Company Wartime Lighting Counselors have Bomber No. 4 more than 50 per cent completed. When this bomber is completed, the group will again hold appropriate christening ceremonies.

Wartime Lighting Counselors of the Houston Lighting and Power Company have completed three bombers in General Electric Company's Bomber Builders Program. The Houston Lighting and Power Company group recently held dedication ceremonies to christen the three bombers completed. The fourth bomber is already 50 per cent completed. Left to right, front row, F. M. Austin, vice-president in charge of sales; H. F. Staacke, general commercial superintendent; and P. H. Robinson, superintendent industrial department. Back row, left to right, L. B. Quinby, N. R. Wall, W. A. Kuenemann, H. Trauernicht, E. L. Goddard, H. L. Plahn, E. C. Kimmons, Jr., J. W. Lowes, Jr., K. K. Breamer, W. N. Attaway, P. W. Joplin, and H. G. Hrivnatz, lighting director.

Office of War Utilities Issues First Order

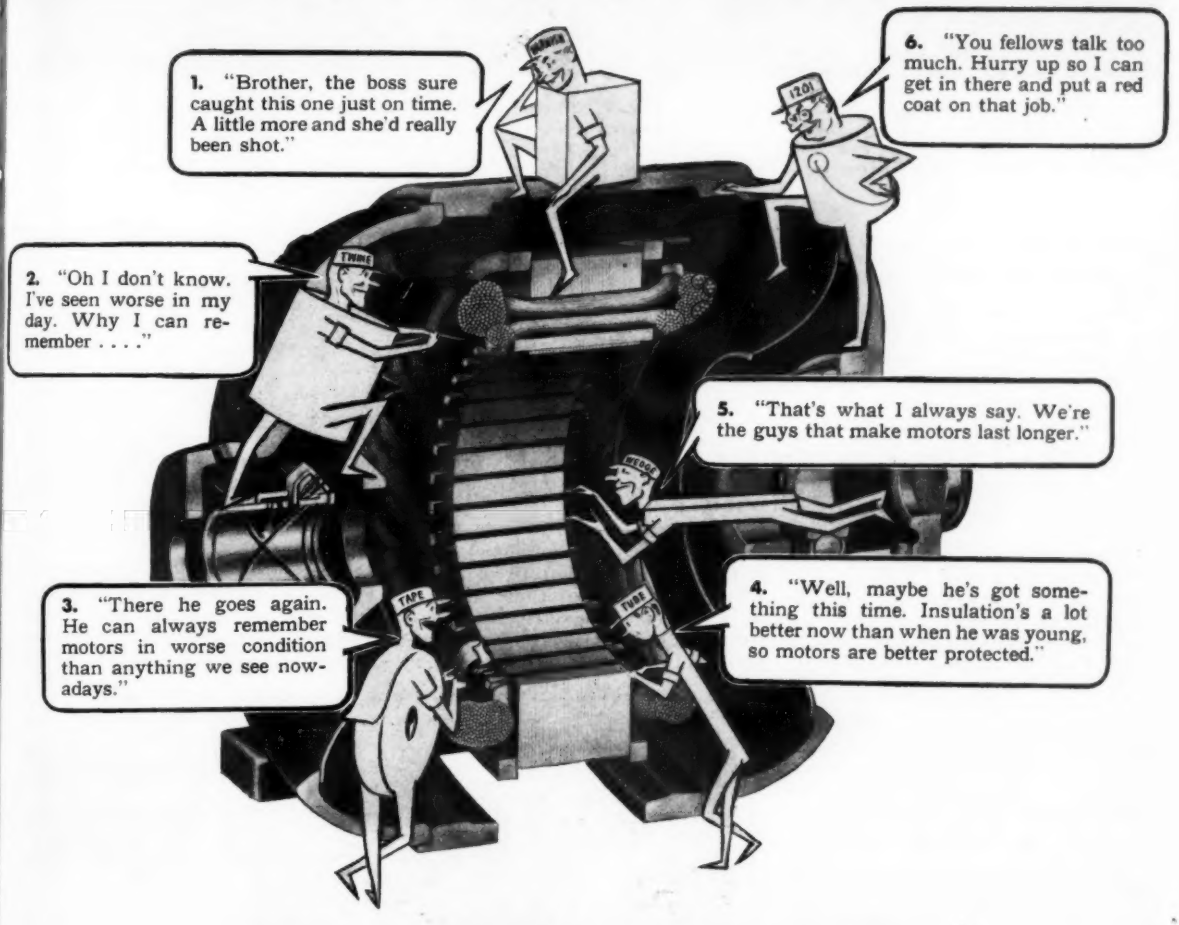
The Office of War Utilities, recently created within the War Production Board to administer war activities of electric, gas, water, steam, and communications utilities, has issued its first basic order, U-1, which replaces the former P-46 and all amendments and supplements thereto, re-enacting most of the P-46 provisions. It governs the flow of materials into the entire utilities field with the exception of communications, and is the first industry order to be integrated with the Controlled Materials Plan.

An important group of provisions within the order, designed to effect sharing of material and equipment in utility inventories, requires utilities to sell surplus stocks as a condition for continuing to receive priorities assistance. These provisions are linked with the creation of regional surplus stock offices, to be in operation throughout the United States in March, through which utilities will carry on the redistribution of their surplus materials and equipment.

The order authorizes the use of a higher rating, AA-1, and a Controlled Materials Plan allotment symbol, to permit utilities to obtain materials for maintenance, repair and minor construction. The order also, for the first time, brings under inventory regulation stocks of controlled material held by utilities for use in construction. It requires utilities to limit such holdings to their needs for the ensuing sixty days.

A sharp reduction in the inventory which may be held for maintenance and repair after March 31, 1943, is made in the new order.

PROTECTING MOTORS
For Longer Life


1. "Brother, the boss sure caught this one just on time. A little more and she'd really been shot."
2. "Oh I don't know. I've seen worse in my day. Why I can remember . . . ."
3. "There he goes again. He can always remember motors in worse condition than anything we see nowadays."
4. "Well, maybe he's got something this time. Insulation's a lot better now than when he was young, so motors are better protected."
5. "That's what I always say. We're the guys that make motors last longer."
6. "You fellows talk too much. Hurry up so I can get in there and put a red coat on that job."
VARNISH
TWINE
TAPE
FIBER
120

THERE'S A G-E INSULATION FOR EVERY NEED

These are only 6 of a complete line of insulation materials designed for service under all conditions. For additional information and catalog giving complete details, write to Section M432-16, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC

In attendance at Perry-Mann's service school, and shown in back of photo from left to right, were F. W. Wheeler, district service representative; Fred Johnson, stock control; Paul Graves, district service supervisor; and J. M. Walker, district appliance sales manager, all of General Electric Company, in Atlanta; and Bob Alexander, service supervisor, Perry-Mann Electric Company, Inc., Columbia, S. C. Fifty service representatives attended the meeting.

Perry-Mann Company Conducts Service School

Pledged to full cooperation with the government's policy relating to the conservation of essential materials so sorely needed for the successful prosecution of the war, the Perry-Mann Electric Company, Inc., of Columbia, South Carolina, invited their servicing dealers throughout South Carolina to attend a one-day service school held in Columbia, on February 23.

Ways and means were discussed to best maintain service and conserve repair parts so vital to the continued operation of the many G-E appliances now in use in this company's territory. Electric ranges, refrigerators, and home laundry equipment were the topics of discussion. Over fifty service representatives attended this meeting.

Southwest Gets Service Schools on Refrigeration

Cramming a six weeks' course in electric refrigeration service and maintenance into five days is the objective of the Frigidaire Service Schools held throughout the Southwest in recent weeks. The students had to burn a little midnight oil, also, to get in all of the course in the brief period from Monday through Friday. The first school was held in Oklahoma City and others followed in Tulsa, Houston, Fort Worth and San Antonio.

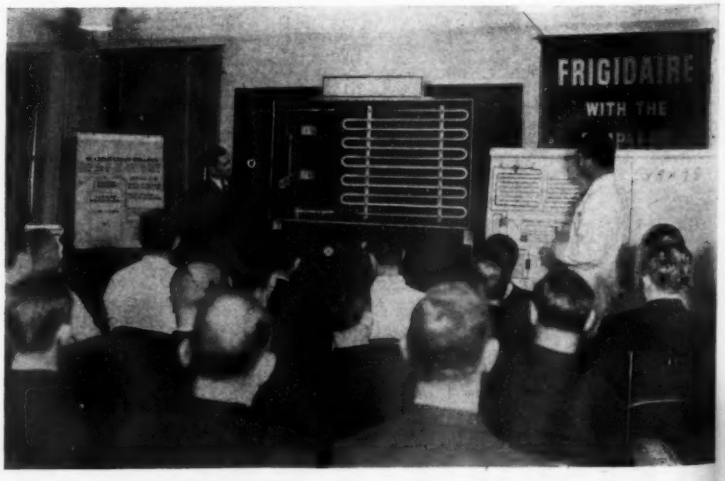
Instructor was W. R. Warner, of Dayton, Frigidaire service field contact man for the southwestern region. In Oklahoma, he was assisted by Price Dukeminier, state district service manager. D. T. Hayward, Frigidaire district manager, Oklahoma City, was responsible for arrangements.

Assisting in promoting the Oklahoma City school was Tom E. Fielder, of Oklahoma Gas & Electric Company. The school was held in an OG&E warehouse building. Students included employees of refrigerator dealers in the Oklahoma City area as well as a few members of the commercial engineering department of OG&E.

Mr. Hayward and Mr. Fielder handpicked the men for the school. They went to the local utility company manager in each town and inquired as to who was in the refrigerator servicing business and who might be interested in attending the school. Then they interviewed the prospective students.

Students at the Oklahoma City school comprised a wide variety of men, all much interested in learning the proper methods of servicing refrigerators. There were men with a little service experience, others absolutely green, and salesmen who had been selling refrigerators for years but knew very little about their mechanical features. Men chosen were in deferred classifications and not likely to be called into the armed forces.

The schools were not limited to Frigidaire dealers and their service men but were open to any serious minded men who wanted to learn refrigerator servicing. While the in-



Frigidaire Service School in Oklahoma Gas and Electric Co. warehouse building, Oklahoma City. Instructor W. R. Warner explains the principle of refrigeration by means of specially constructed Frigidaire unit with glass coils.

JACKS
TACKLE
ROPE
SHOVELS
PLIERS
CUTTERS
LEATHER
RUBBER

New HANDY GUIDE TO LONGER TOOL LIFE

Helps to save time...avoid breakdowns...conserve materials

Here's a convenient, practical handbook that tells how to get the greatest service out of tools that may be irreplaceable for the duration. On more than thirty separate items, it gives suggestions for use, advice on adjustment, lubrication, storage, and the like.

Pocket size, with durable stitched binding, this new handbook fits the needs of everyone responsible for care and servicing of tools, for employee training, and for setting up standard practices. It was prepared with the cooperation of leading manufacturers of these supplies as a part of GRAYBAR'S complete service "from the top of the pole to the bottom of the hole."

For your copy of "Wartime Care" just call your local GRAYBAR Representative or use the coupon below. Remember, too, that there's no better Procurement Advisor on difficult-to-get new line tools and supplies than your GRAYBAR Man.

Graybar
IN OVER 80 PRINCIPAL CITIES

JUST MAIL COUPON

GRAYBAR ELECTRIC COMPANY
Dept. ES, Graybar Building, New York

Gentlemen: Please send me a free copy of your new 32-page handbook "Wartime Care of Line Construction and Maintenance Tools."

Name _____

Company _____

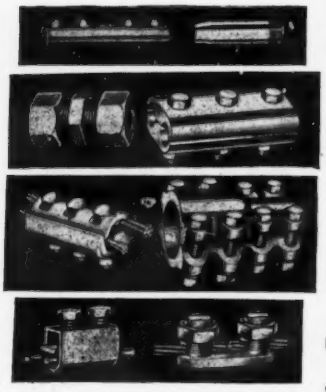
Address _____

City and State _____

"It sure is HANDY— to have ALL kinds in One Catalog!"

For any good Straight or Parallel *Connector, see the* **COMPLETE** *line*

These illustrations can only suggest the wide variety in the Penn-Union Catalog . . . a *complete* line of Bolted Straight Connectors and Reducers . . . Screw type . . . Split Sleeve type . . . Shrink fit . . . Universal Parallel Clamps . . . E-Z Connectors that take a wide range of conductor sizes.



Also . . . the most complete line of Service Connectors, Tee Connectors, Cable Taps . . . Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Terminal Lugs.

Penn-Union connectors are the first choice of leading utilities, industrials, electrical manufacturers and contractors because they have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.*

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309 Walton Building
ATLANTA, GA.

WALTER J. HUEMMER
Dallas Transfer & Terminal Warehouse Bldg.
DALLAS, TEXAS

PENN-UNION ELECTRIC CORPORATION
ERIE, PA.

PENN-UNION
Conductor Fittings

struction was on Frigidaire units, such being used for shop models, nevertheless the theory of refrigeration and its principles were taught so a man could go back home and service any make refrigerator.

OG&E was interested in the school because it will help its customers maintain full usefulness of their electrical equipment. The company operates no service or repair department for customers so gladly cooperates with any and all manufacturers or distributors in helping appliance owners obtain the best possible service from their equipment.

Maintenance and Repair Order Explained

A revised definition of what constitutes maintenance and repair of a building is contained in an amendment to Conservation Order L-41, which was made effective recently. The new definition specifically designates that where a single job is partly maintenance and repair and partly new construction, the whole project will be considered new construction and subject to Order L-41.

In addition, the amendment reduces to $200 new construction which may be undertaken, without specific authority, by a number of manufacturing enterprises which are not essential to the war program. Moreover, the amendment applies to private dwellings and commercial structures.

Order L-41 is a limitation order which is designed to prevent unnecessary construction in order to conserve materials, facilities and labor for essential war uses. It acts to shut off the flow of materials from normal peacetime construction and route them to essential war jobs.

Under the new definition, maintenance and repair means the work that is necessary to keep a structure in sound condition, but does not include any building operation involving a structural alteration or change in design.

In specifying industrial structures whose exemption under L-41 is reduced to $200, the amendment embraces all structures which have as their principal function the manufacture, processing, or assembling of any of the following: athletic supplies, sporting goods, toys or games; beverages (except milk); books, magazines, newspapers, greeting cards, or other printed or engraved matter; candy or chewing gum; jewelry, watches, traveling bags, brushes, razors, pipes and like articles for personal use or adornment; furniture, silverware, china, household electrical appliances, draperies, and all similar articles; musical instruments; stationery or office supplies, toiletries or cosmetic products, and all sorts of wearing apparel, except that for the Army or Navy. Any industrial construction with a productive floor area of less than 10,000 square feet is also included. The amount of exemptions previously allowed these structures varied.

The amendment to Order L-41 brings into the foreground these other principal changes in the regulation of construction:

1. Provision is made for emergency work on any damaged structures for the protection of the structure and the public.

2. In prohibiting construction in violation of L-41, the amended order forbids not only the beginning of such construction but also forbids carrying on or participating in the work.

3. The cost of construction as defined in the order has been narrowed to exclude financing and insurance charges as elements of cost.

4. The exemption of certain types of agricultural construction is permitted to reflect the USDA rationing program.

The order, as amended, provides that no construction may be begun or carried on unless it is specifically authorized by the War Production Board or unless the estimated cost of the project is limited to stated amounts. These amounts limit construction to $200 for residential and some specifically mentioned types; $1,000 for multiple residential; $1,000 for agricultural; $5,000 for industrial; and $1,000 for "other restricted" construction not otherwise classified.

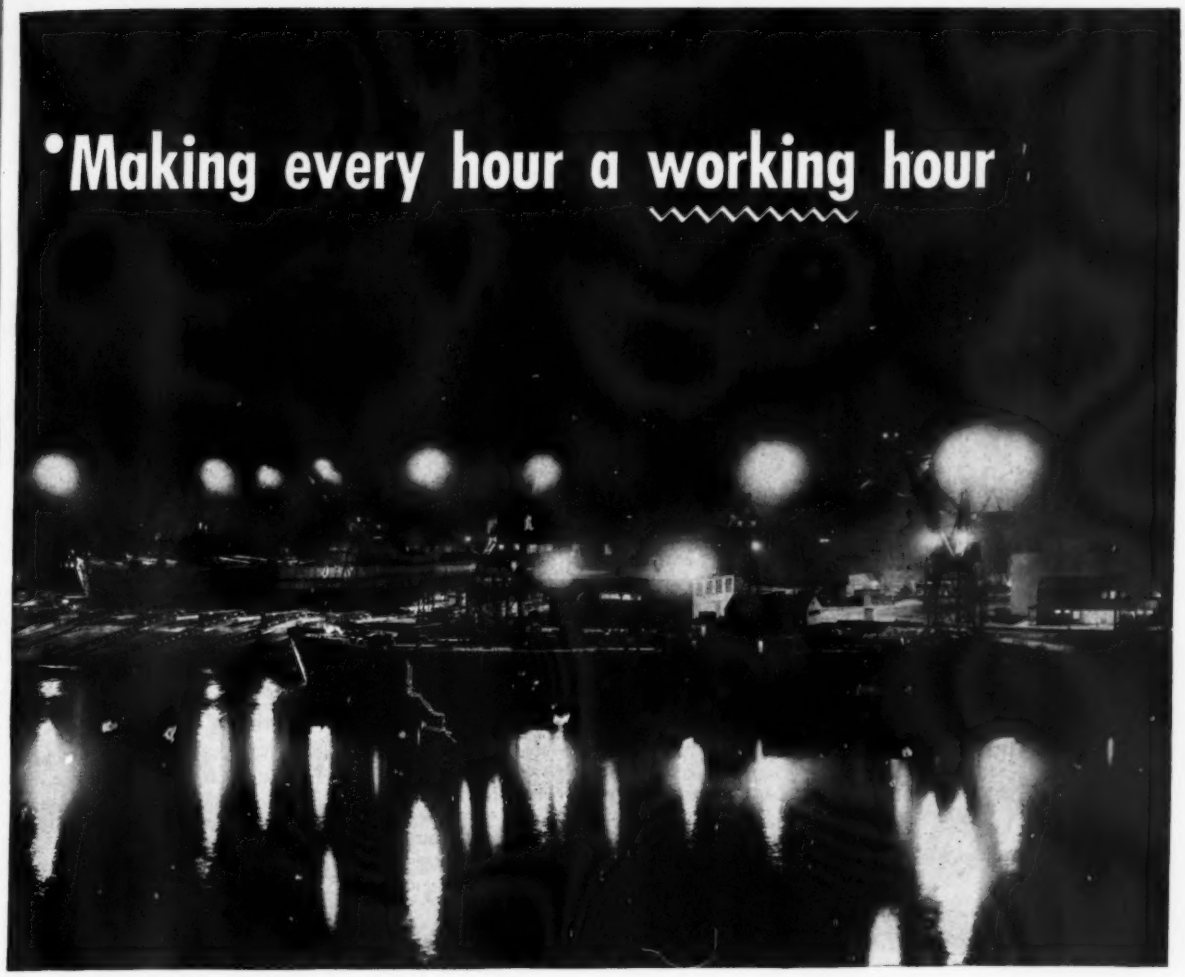
Electrical Wholesalers To Hold War Conference

Because of the tremendous importance of the products of the electrical industry in winning the war and also because of the necessity for improving and speeding up distribution methods for getting those essential materials where they are needed most efficiently and speedily, the National Electrical Wholesalers Association has decided to hold an Industry War Conference, at the Hotel Statler, Buffalo, New York, May 24 to 26 inclusive.

The program committee includes the following: W. I. Bickford, Westinghouse Electric Supply Co., Pittsburgh, chairman; D. L. Fife, Fife Electric Supply Co., Detroit; and W. J. Kranzer, Crannell, Nugent & Kranzer, Inc., New York.

NEMA Committee on Public Information Announced

Organization of a public information committee within the Household Refrigeration Section of the National Electrical Manufacturers Associa-

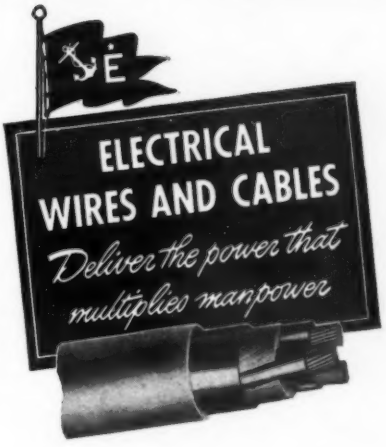


MORE destroyers and aircraft carriers! More sub-chasers! More landing barges! More cargo ships! More—more—more!

How is this enormous demand to be met? The best answer is 24-hour-a-day production. And that requires unfailing transmission and distribution . . . power for hard-working machines, for welding, for lighting, for communication. For victory may well hinge upon the ability of America's shipyards to produce boats in ever-increasing numbers at record-breaking speed.

Only the best Electrical Wires and Cables can be trusted with these responsibilities . . . Wires and Cables as trustworthy as modern manufacturing methods can make them.

That is why products of American Steel & Wire Company play such important roles in wartime ship construction. Our engineers are working constantly to improve quality. Tireless research goes on day after day. New ideas, new production methods are studied — tried. When peace comes, American Steel & Wire Company Electrical Wires and Cables will be ready to meet the even greater demands of the postwar world.



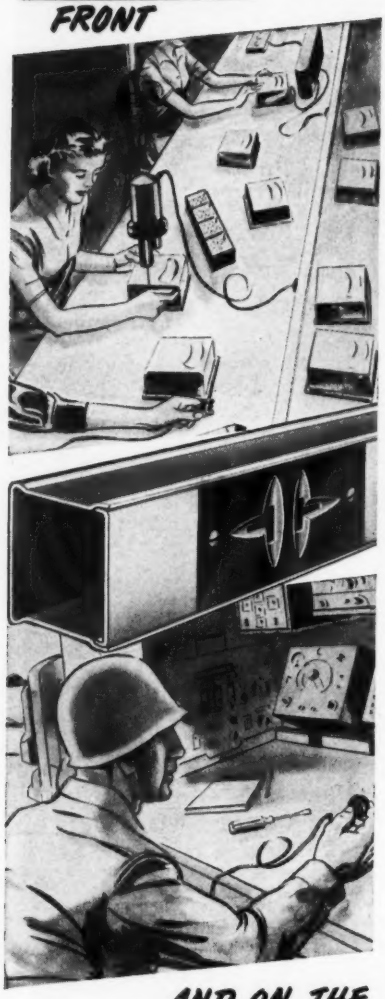
AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* — United States Steel Export Company, New York

UNITED STATES STEEL

ON THE
PRODUCTION
FRONT



AND ON THE
FIGHTING
FRONT...

PLUGMOLD
is helping to
"GET IT OVER QUICKLY"

Men working in mobile electrical units on the front line...and women working at assembly and inspection benches in war plants...appreciate PLUGMOLD "plug-in-anywhere" industrial convenience wiring for the same reasons...outlets right where they're needed ...short extension cords...time and motion savings...faster ACTION. Every plant needs PLUGMOLD somewhere. Listed by U. L; Conforms to Federal Specification W-R-32. The Wiremold Company, Hartford, Conn.

WIREMOLD

CAN HELP YOU PRODUCE FOR WAR AND PLAN FOR PEACE

tion has been announced by Charles R. D'Olive, chairman of the section.

Members of the committee are Lawrence W. O'Brien, General Electric Company; Richard E. Gauen, Nash-Kelvinator Corporation; and James A. Baubie, Westinghouse Electric & Manufacturing Company, chairman.

"This committee will report on the important war production activities of the refrigerator manufacturing industry and inform the public on refrigeration developments which will affect post-war living," the announcement stated.

From Washers to Gun Mounts Is Norge Record

From selling washers to manufacturing mounts for the deadly Oerlikon anti-aircraft gun may seem like a far cry, but that was the war-time shift made by Earl R. Bridge and R. H. Pizor, of the Norge Division, Borg-Warner Corp. Bridge was in charge of Norge washer sales for many years and Pizor was closely associated with him for nine years.

For many months now both have continued their teamwork at the plant of the Norge Machine Products Division, Borg-Warner Corp. This new division was created before Pearl Harbor in the hope and expectation of making a substantial contribution to the war effort. A vacant plant was purchased, completely reconditioned, equipped with newly-purchased machinery and staffed by new management personnel.

For want of a title, Bridge might be called assistant to O. H. Shenstone, plant manager, but his duties would be more clearly defined by stating that he is a super-co-ordinator among the ten major departments of the plant. He himself explains his work by saying, "If we fail to produce gun mounts on schedule, it's my fault."

Pizor's job is easier to define. He fills the intermediate step between personnel and management without the title but with the duties of a labor relations manager.

Walk through the plant with either of these former sales executives and you will hear many first-name greetings bandied back and forth with men on the bench. For both Bridge and Pizor have applied some of the first principles of good salesmanship to production management and have helped considerably in building an employe morale that is leading to a constantly expanding production.

Starting from scratch in late 1941, the plant is already completing its basic contract, ahead of schedule. Supplements to the original contract assure continued production.

Miller Elected Asst. Secretary Of Southern Section, IAEI

G. M. Miller, electrical inspector for the city of Richmond, Va., was recently elected to the position of assistant secretary of the Southern Section, International Association of Electrical Inspectors. This move was made recently by the executive committee of the Southern Section, headed by George Welman, in anticipation of the fact that C. M. Jones, Underwriters' Laboratories field engineer of Atlanta, and present sec-

Earl R. Bridge and R. H. Pizor (left and center) who have worked together for many years in the interests of Norge washers, are still teamed up in assisting the war-time management of the Norge Machine Products plant at Muskegon, Michigan. Here they are talking with O. H. Shenstone, plant manager, (right).

What did *you* do today ... for Freedom?

Today, at the front, he died ... Today, what did *you* do?
Next time you see a list of dead and wounded, ask yourself:
"What have *I* done today for freedom?
What can I do tomorrow that will *save* the lives of
men like this and help them win the war?"

To help you to do your share, the Government has organized the Citizens Service Corps as a part of local Defense Councils, with some war task or responsibility for every man, woman and child. Probably such a Corps is already at work in your community. If not, help to start one. A free booklet available through this magazine will tell you what to do and how to do it. Go into action today, and get the satisfaction of doing a needed war job well!

EVERY CIVILIAN A FIGHTER

CONTRIBUTED BY THE MAGAZINE PUBLISHERS OF AMERICA

THE PLACE TO LOOK FOR ELECTRIC WIRING MATERIALS

It's YOURS for the writing

360 pages of vital engineering data on National Electric quality products.

Covers roughing-in wiring systems. Each section contains the complete listing of one system and all the fittings for that system. Eliminate guess work by using a National Electric Data Book in your office.

National Electric
PRODUCTS CORPORATION
300 SIXTH STREET, PITTSBURGH, PA.

retary-treasurer of the Southern Section, may soon enter the armed forces.

For some time, Mr. Miller has been secretary of the Virginia Chapter, IAEI and he continues in that capacity. He is particularly familiar with association affairs, has an excellent knowledge of the Code and its problems, and has energetically furthered the interests of the electrical inspector.

Taylor Named Head of New G-E Division

Product Service becomes a division of General Electric Company's Appliance and Merchandise Department, and L. H. Taylor is appointed manager of this Division, it has been announced by H. L. Andrews, vice-president in charge of the A. & M. Department.

The establishing of Product Service as a division is proof that service has earned a more important place than ever before in the A. & M. organization. It reflects the success with which General Electric's product service men have used the knowledge gained in pre-war field experience to help distributors and dealers keep the millions of America's appliances in working condition for the duration.

By setting up factory-operated Appliance Service Centers in key areas to make parts and service accessible, by offering complete packaged training programs to distributors for the training of service men in key cities, and by a definite, well-planned overall program for identification of qualified servicing dealers and continued assistance for them, the product service organization has earned its division status.

Product service of the appliance divisions at Bridgeport, and of the Air Conditioning and Commercial Refrigeration divisions at Bloomfield, become sections of the newly created Product Service Division. W. C. Noll, Bridgeport, and R. U. Berry, Bloomfield, continue as managers of these respective sections, the announcement states.

Mr. Taylor, manager of the new division, has been with General Electric since 1925. He was on the company's travelling auditors staff for six years, four years of which were spent abroad. His travels took him to South Africa, England, the Far East, and Central America.

Joining the Appliance & Merchandise Department in 1938, Mr. Taylor became assistant manager of credits and collections. He was appointed assistant to the appliance sales manager in 1940, and since the outbreak of war has been coordinating contracts on a product being made for the Navy.

New Orleans School Trains Servicemen

A distributor-utility service school, the effect of which may be the exploration of a new source of manpower for the dwindling available appliance service workers, was conducted in New Orleans February 8 to February 20, inclusive.

The school may, in fact, result in tapping two new sources of service people to keep the household appliances of the New Orleans area in operation during the war. These are possible utilization of automobile service station employes for appliance servicing, and the increasing supply of women now entering industry and nearly all employment.

The service school was arranged by the Louisiana Power and Light Company and the New Orleans Public Service, Inc., in cooperation with principal local distributors for leading appliance manufacturers.

The school, or series of schools, were conducted at the distributor headquarters of the appliance concerns in New Orleans and at the New Orleans Public Service, Inc., and were attended principally by representatives of the utility concerns, who will return to their homes in various parts of Louisiana and Mississippi with the idea of instructing others in appliance servicing. It is hoped that auto mechanics or operators of service stations can be induced to take on appliance servicing after they have been instructed by those who attended the New Orleans school.

In addition to the utility representatives who attended the school, some 15 young women who had become interested in this work at the L. E. Rabouin school, a manual training institution, also attended. These were given practical demonstrations in appliance servicing and were given theoretical training at the school. These will, leaders in arranging for the school said, form a possible reservoir for appliance service needs in New Orleans.

Men who attended the school were chosen by their companies with a view to their later giving instruction to others in their hometowns. They included eight men from the Louisiana Power and Light Company, six from the Mississippi Power and Light Company and six from the New Orleans Public Service, Inc.

Electrical Manufacturers Get Army-Navy Awards

American troops who invaded North Africa needed more than 25,000 pieces of ordnance equipment, Brigadier-General A. G. Gillespie, commandant of Watervliet Arsenal, Watervliet, N. Y., disclosed when

awarding the Army-Navy "E" pennant symbolizing outstanding war production to the Westinghouse East Springfield, Mass., plant recently.

Declaring "there can be no letdown in your efforts," General Gillespie told thousands of workmen assembled for the presentation that "the amount of equipment needed for our troops in the field is enormous. It totals millions of rounds of ammunition and thousands upon thousands of tanks, planes and guns."

The Westinghouse East Springfield Plant, a unit of the Electric Appliance Division of the Westinghouse Electric and Manufacturing Company, is producing equipment for tanks, planes, cargo and fighting ships and other war plants. It became the eighth Westinghouse plant to receive the Army-Navy "E". Before converting to war production, it was engaged in manufacture of household refrigerators, vacuum cleaners and other electric appliances.

As he presented the flag to William O. Lippman, Westinghouse works manager, and Leo Benoit, employe representative, General Gillespie said that only one per cent of all plants engaged in war production had been given the right to fly the "E" flag.

* * *

Philco Corporation has been awarded the Army-Navy "E" with a white star for continued "meritorious services on the production front". Converted 100% to war work, Philco is turning out electronic equipment for planes, ships, and tanks, shells, fuses and industrial storage batteries for the Government.

The original "E" Award presentation to Philco Corporation, one of the first in the country, was made on August 14, 1942 by Brigadier General A. A. Farmer, commanding officer, Philadelphia Signal Depot.

In writing to inform Philco of the new award, the Hon. Robert P. Patterson said:

"I am pleased to inform you that you have won for the second time the Army-Navy Production Award for meritorious services on the production front.

"You have continued to maintain the high standard that you set for yourselves and which won you distinction more than six months ago. You may well be proud of your achievement."

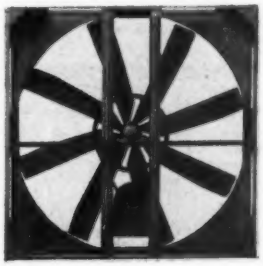
* * *

The distinction of being one of the first washer and ironer manufacturers to receive the Army-Navy Production Award goes to the employees of Altorfer Bros. Company, Peoria, Illinois. The presentation of war goods, were held in the company plant, before a large gathering

Check up on this BACKLOG of Prospects

for Coolair TRADE MARK

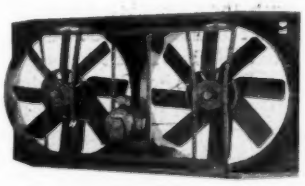
EXHAUST FANS and BLOWERS!



WARM weather is sure to bring out, in Army and Navy establishments and in war production plants all over the country last year's countless unsolved ventilating problems. This will create your greatest opportunity to build up summer business and profits through sales of Coolair Exhaust Fans and Blowers.

This great backlog of prospective orders will be doubled by the addition of *new* prospects with the coming of real hot weather. Army and Navy officials, and war plant executives, know that both morale and efficiency of men and women are improved when offices, shops, messhalls, kitchens, hospitals, and other military and industrial war plant buildings are properly ventilated and cooled by the rapid removal of overheated, humid air.

Whether or not you're located in a military or war production area, remember — there will be almost unlimited opportunities for post-war sales of Coolair Exhaust Fans and Blowers to such services and businesses as laundries, bakeries, hotels, trade schools, theaters, recreation halls and restaurants . . . IF you start NOW to build a live file of such prospects! Many Coolair dealers are going to "cash in" on their Coolair post-war prospect files when we are again able to supply our dealers from coast to coast with their full needs in the Coolair line!



A full description of the Coolair line, with tables showing models, dimensions, performance data, etc., can be found in

SWEET'S CATALOG A.S.H.V.E. GUIDE

ELECTRICAL BUYER'S REFERENCE

AMERICAN COOLAIR CORPORATION

3604 Mayflower Street Jacksonville, Florida

of employees and their families, company officials and distinguished guests.

Norman Ross, radio announcer, officiated as master of ceremonies. Receiving the coveted "E" Banner, and speaking on behalf of the company, were Henry W. Altorfer, vice president and general manager, and M. J. Broderick, assistant to A. W. Altorfer, president of ABC.

Presentation of the flag was made by Brigadier General Donald Armstrong, commanding general, Ordnance Replacement Training Center, Aberdeen, Md., with Lieut C. T. Walter, representing the Navy, making the token presentation of the "E" pins to ABC employees.

PERSONAL NOTES
About Men You Know

E. B. Glenn, manufacturers' representative, has announced a change of address. Mr. Glenn's new offices will be located at 801 Healey Building, Atlanta, Ga. He is southern representative for the Columbia Metal Box Company, New York City, and Walker of Conshohocken, Pa.

* * *

The Board of Directors of the McGraw Electric Company have announced the election of **Murray Ireland** as vice-president in charge of production for the Toastmaster Products Division, at Elgin, Illinois.

Mr. Ireland's association with the automatic toaster industry dates back to its birth. He joined the Toastmaster organization in 1925 as designing engineer, and in 1927 advanced to the position of superintendent, which post he has held since that time.

* * *

Harry J. McKnight, service manager of the Richmond, Va., branch of the Graybar Electric Company, died February 3, following an illness of several months. Mr. McKnight was a native of Philadelphia and was educated at the University of Pennsylvania. He entered the service of the Graybar Company in his youth and had made his home in Richmond since 1924.

* * *

Albert E. Alverson, secretary of Greenlee **Bros. & Co.,** Rockford, Illinois, of which Greenlee Tool Co., is a division, has retired after 42 years of service with that organization. Mr. Alverson joined Greenlee in Chicago in 1900, returning to his home city of Rockford in 1904 when the company moved its plant there. In addition to being secretary of the company, Mr. Alverson for many years has been in charge of all tool sales for Greenlee Tool Co. and its parent organization.

O. Vincent Haegg, assistant secretary and manager of woodworking machinery sales, succeeds Mr. Alverson as secretary. Management of tool sales will be handled by **Raymond J. Samuelson,** who has been assistant to Mr. Alverson for 19 years.

R. J. Samuelson

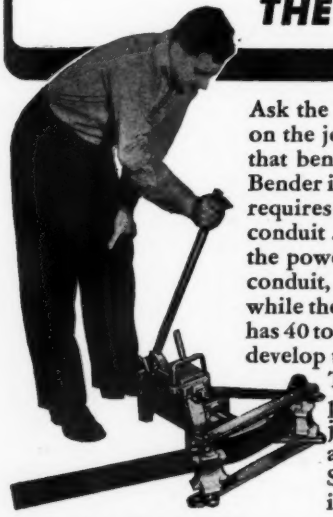
Other officer changes at Greenlee include the election of **Albert H. Eggers** as president to succeed **George C. Purdy,** who becomes chairman of the board, and the naming of **Leslie H. Geddes** as second vice-president.

* * *

Appointment of **Hugh Saussey** as southeastern division manager has been announced by **Robert H. Bishop.**

Hugh Saussy

GREENLEE BENDERS
EASIER AND FASTER FOR THE MAN ON THE JOB



Ask the man who knows . . . the operator right out on the job doing the bending . . . and he'll tell you that bending conduit with the Greenlee Hydraulic Bender is even easier than it looks. To bend conduit requires power . . . approximately 31 tons for 4-inch conduit . . . and Greenlee Hydraulic Benders have the power. The No. 770 Bender, for 1¼ to 3-inch conduit, has 25 tons of easily developed power, while the No. 775 Bender, for 3 to 4½-inch conduit, has 40 tons of hydraulic power. One man can quickly develop this power by simply pumping the handles. These light, portable benders are built compactly into one unit, are easily carried to the jobs and set up, and will not move and twist about when in use. Our Bender Booklet S-116 will show you how you can cut bending costs on every job.

Greenlee No. 770 Bender

Send for BENDER BULLETIN S-116

GREENLEE TOOL CO.
1764 COLUMBIA AVE., ROCKFORD, ILL.

general sales manager of the Lighting Division, Sylvania Electric Products, Inc. Mr. Saussy has been Sylvania's sales representative in this territory for the past year and a half and will now coordinate all Sylvania lighting sales activities with headquarters located at 922 William Oliver Bldg., Atlanta, Georgia.

* * *

Ted Gravenson, former advertising manager of the Burndy Engineering Company has joined Doyle, Kitchen & McCormick, Inc., as account executive.

* * *

"To add impetus to the promotion of Engineered Light for Seeing in industrial operations and of the Near Infra-Red Process for baking, drying, dehydrating and preheating tasks in industry"—that is the reason for creation of two new divisions of The Fostoria Pressed Steel Corporation, Fostoria, Ohio, according to **E. L. Bates,** vice-president and director of sales.

W. S. Crandall

The announcement just released places **W. S. Crandall** in charge of all near infra-red equipment activities. Mr. Crandall has been associated with the company as western division manager and director of engineering. In charge of all lighting equipment activities is **Lawrence Goble,** who for the past dozen years has been associated with Indiana Service Corporation, Ft. Wayne, Indiana.

Lawrence Goble

RE-LIGHTING

the new manpower / production *requirement*

OPERATION STUDY SHEET

Working Conditions *Light glare, causing hazardous working conditions—high accident rate on this section*

delays—new worker

Machine No. *340*

Capacity —

Size —

Department *N-32*

Vital to accident-rate reduction

Glaring or insufficient light that makes seeing difficult is one of the principal reasons for lost-time accidents. *Re-lighting* your plant will help you save many of these man-hours of production, particularly on your night shifts.

Most plants operating today were designed and built for peacetime, daylight working schedules. *Lighting based on daylight conditions is inadequate to serve the needs of night workers.*

Re-lighting does not mean discarding your present lighting system. It merely means increasing the efficiency of your present equipment by re-locating lamps to eliminate glare and shadow, increasing lamp wattages where necessary, or installing additional equipment to insure uniform lighting levels. A Silv-A-King lighting engineer can tell you exactly what you need and how little re-lighting will cost.

Silv-A-King has specialized in industrial lighting for 22 years. Silv-A-King quality equipment (fluorescent or incandescent) plus a Silv-A-King "engineered layout" makes an unbeatable combination.

BRIGHT LIGHT REFLECTOR COMPANY, INC.
310 Morgan Avenue, Brooklyn, N.Y.

UL SILV-A-KING RLM

Send for your copy of our 16-page book: "Light Is An Essential Production Tool"

SILV-A-KING

MAKES *Light* WORK FOR YOU

BROILKING AFTER THE WAR, MORE THAN EVER *America's Finest Electric Table Broiler*

INTERNATIONAL APPLIANCE CORPORATION

1027 Metropolitan Avenue, Brooklyn, N. Y.

NEW EQUIPMENT and MATERIALS

New "Fuse-Bond" Process

Metallizing Engineering Co. Inc. announces the revolutionary new Fuse-Bond process, and equipment for its application, whereby machine components and similar metal arts now may be prepared for metallizing electrically. Main advantage of the process is that it affords an adequate bond on the hardest surface, heretofore impossible or impractical preparation of narrow edges, flat areas, and cylindrical parts having keyways, and other interruptions in their surfaces.

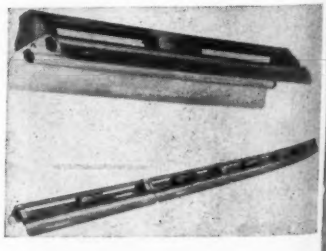
Application of the process is with the Metco Fuse-Bond unit. Operating on any 110 or 220 volt, single-phase power line, this equipment fuses a rough deposit of electrode metal into the surface to be metallized. Electrodes are applied to the work with a special holder which uses up to six electrodes at a time, depending on the size and nature of the part to be prepared. Small parts may be prepared with this equipment as easily as large shafts, since there is no excessive heating of the base metal, or disturbing of its physical characteristics.

The Fuse Bond Unit is extremely compact, and is contained in a cabinet measuring only 24" high. Weight complete is but 170 lbs. All cables and attachments fit into a bin in the top of the cabinet. Mounted on casters, it can be wheeled right to the job with ease. A complete instruction manual provides all operating data. Unskilled labor can operate efficiently within an hour or so. Further information on the process and its equipment is contained in Bulletin 44, obtainable from Metallizing Engineering Co., Inc., Long Island City, N. Y.

Mitchell Creates New All-Purpose Fixture

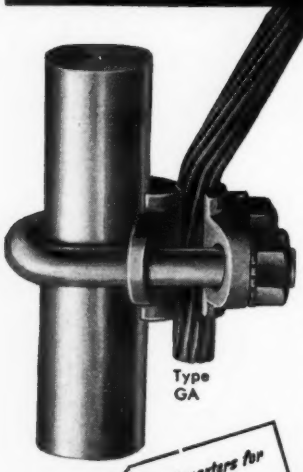
An entirely new idea in fluorescent fixture design has been developed by the Mitchell Manufacturing Co., Chicago, to meet governmental requirements and yet give war industry the fluorescent lighting it needs. The new Mitchelite is a complete innovation. It meets all WPB and U. S. Bureau of Standards regulations, including the latest WPB Amendment to Limitation Order L-78, dated January 26, 1943. (40-watt Mitchelite units contain less than 3 pounds of steel per fixture, 100-watt units contain less than 4 pounds of steel per fixture.) At the same time, it retains every good lighting feature of the past and adds new, improved features that make it more simple, more flexible, more economical to install and maintain. Though lighter in weight, the new Mitchelite line is ruggedly built for long service. All models are Underwriters' Laboratories and E.T.L. Fleur-O-Lier Approved throughout.

A wide range of accessories and fittings, designed to save time installing and servicing, make Mitchelite readily adaptable for every conceivable method of mounting or hanging, to fit every lighting situation in factory, office or drafting room. Each model can be used for both individual and continuous row lighting, for surface or suspension mounting.



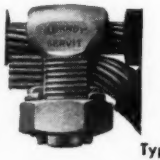
Exclusive new-type, easy-fit wireway channel simplifies the problems of wiring and mounting for continuous rows. Units can be joined end-to-end in continuous rows more quickly than has been possible before, simply by removing wireway end caps and replacing them with easy-fit "Couplers" which quickly and easily connect unit wireway channels. Sin-

Sure Ground



Burndy Ground Connectors afford reliable, *low resistance* ground connections, with *high resistance* to underground corrosion. All parts are designed for ample strength, and each Burndy Ground Connector is *engineered* for its own specific job.

And that's true of all Burndy Connectors. Take the Burndy Servit, for example. This compact service connector gives some 50% greater pressure on the conductors – thanks to a design which wastes less torque in overcoming thread friction. Each size accommodates a large range of conductors and can be used over and over again. Bulletin on request.



Headquarters for Connectors

Burndy GROUND CONNECTORS
BURNDY ENGINEERING CO., INC.
107 EASTERN BLVD., NEW YORK CITY

gle units can readily be dropped down from rows by lifting wireway "Coupler." Where units are mounted in rows, but not end to end, blank channel can serve as continuous wireway. No conduit or other cabling is necessary. If additional illumination is desired later, additional fixtures can easily be added.

New-type wireway also permits locating **ballast on "outside".** This results in greater air circulation, cooler operation and longer life of ballast. Starters and sockets are also made easily accessible, without disturbing lamps.

Reflectors are non-metal "Lumenite"—a specially-treated new composition which is tough and sturdy, moisture and high-heat resistant, non-corrosive, non-scaling. Gray outside, white inside. High gloss baked enamel finish gives high reflection factor.

Reflector can easily be installed or removed from end pieces in a few seconds by a few turns of wing nuts. No tools needed.

The new Mitchelite fluorescent lighting is available in four models—each model so flexible it can be used for both individual and continuous row mounting. Model No. 2075 for 2 40-watt lamps—Model No. 2076 for 3 40-watt lamps—Model No. 2077 for 2 100-watt lamps—and Model No. 2078 2-section unit for 4 100-watt lamps which operates with one "Forlamp" ballast. Each model consists of the new steel wireway channel with removable end caps, approved ballast, two end-pieces which hold sockets, starters and reflector. Comes completely wired ready for hanging. Power **factor is 90 per cent.** Stroboscopic corrected. **The Model No.** 2075 illustrated is 50 inches long, 14 inches wide, and 9½ inches high.

Models 2075, 2076, 2077 are for standard operating voltage of 110-125 volts, 60 cycle a-c, but are also available in higher voltages. Model 2078 is for 250-280 line voltage only.

For further information, write to your Mitchell **distributor for** Mitchelite Catalog No. 400, or write direct to Mitchell Mfg. Co., Chicago, Illinois.

Wood Storage Cabinets

The W. C. Heller & Company, of Montpelier, Ohio, has announced a line of wooden storage cabinets, wood shop desks, and wood drill cabinets to take the place of such items formerly made from steel.

The storage cabinets, 36 inches wide and 72 inches high, are available in both 24-inch and 18-inch depths. They are especially suitable for storage of small parts, supplies, etc., for the industrial electrician, appliance service firms, electrical contractors, and others.

The wooden drill cabinets are available in a variety of sizes. Top sides and back are solid oak finely finished in a rich antique oak varnish. The drawers are available with various compartment arrangements. They protect drills from dust and rust and eliminate losses.

For further information on these products, write W. C. Heller & Company, Montpelier, Ohio.

"Operation Successful!"

A few minutes ago this Navy surgeon completed a difficult operation on a wounded fighter pilot. The operation was successful . . . his charge will live to fly and fight and win again!

His job is not an easy one. The hours are long and the work nerve-racking. Yet he must always be calm, confident, steady of hand and clear of mind.

This is just one of the reasons why our entire wartime output of R & M Fans is reserved for vital ventilating jobs in military hospitals and on shipboard. In addition to helping physicians do their *best* work by keeping the air fresh and invigorating, these famous breeze-makers are helping wounded men recover *faster* by making their days of convalescence more comfortable.

It's easy to see, isn't it, why there'll be no R & M Fans for *civilian* use, for the duration? We're sure *you're* as proud as *we* are that they're helping to save lives . . . to save the American way of life.

•

ROBBINS & MYERS • INC.

SPRINGFIELD, OHIO • Branch Offices in:

NEW YORK, 200 Varick St. CHICAGO, 2400 W. Madison St. PHILADELPHIA, 401 N. Broad St.
KANSAS CITY, B. M. A. Bldg., Room 325, 215 Pershing Rd. SAN FRANCISCO, 237 Rialto Building
NEW ORLEANS, 116 Arlington Dr. DALLAS, 1100 Cadiz St.
THE ROBBINS & MYERS CO. OF CANADA, LTD., Brantford, Ont.

This advertisement does not imply endorsement of our product by the armed forces.

LOXON GRIPON

. . . guard against breakage and theft!

THE NEW LOXON
No. 1427-A

THE NEW GRIPON
No. 1602-A

The McGILL LoXon Guard is your best assurance for protection against breakage and theft because it locks on with a key! However, where theft is a minor issue, the Gripon is fully as effective against breakage. The only difference in construction is that the key locking device on the LoXon is replaced by plain steel screws on the Gripon. New improvements have recently been made on these two guards:

1. **Shape has been changed to conform to new style lamps.**
2. **Heavier wire is used — No. 14 instead of No. 15.**
3. **Both LoXon and Gripon are available with or without reflectors.**
4. **There is NO increase in price — only increased value for the user!**

McGILL Products Can Be Secured from Your Electrical Wholesaler.

McGILL MANUFACTURING CO.
Electrical Division, VALPARAISO, IND.

McGILL

Welding Aluminum

An attractive 100-page booklet entitled "Welding and Brazing Alcoa Aluminum" is now available from the Aluminum Company of America, Pittsburgh, Pa.

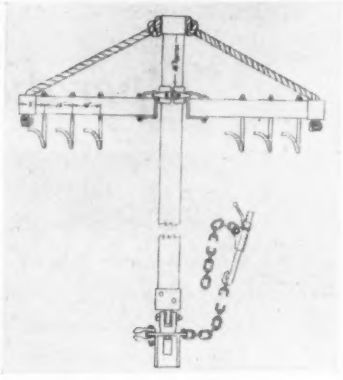
Designed to conserve aluminum and speed up vital production, this booklet explains how to correctly use and work the metal. By following its instructions, waste and scrap losses can be eliminated and tool breakage greatly reduced.

The section of the booklet on welding describes gas welding, arc welding, and electric-resistance welding of aluminum products.

The latter part of the booklet describes various methods of brazing Alcoa Aluminum including furnace, torch, dip brazing and castings brazing. Numerous illustrations and diagrams are included.

Temporary Cross Arms

For holding distribution lines above a cross arm while the arm is being changed, the Tips Temporary Distribution Cross Arm has been developed. It may be used on voltages up to 4 kv and for changing either four or six pin arms.



Using a hand line, this lightweight device can be easily lifted up between the phases to the position desired for mounting on the pole. The arms swing up and lock in an upright position which greatly facilitates this operation. A Tips Saddle Clamp quickly secures the tool to the pole at the bottom. A rope ties it in place above.

When the arms are lowered, the various phase wires may be lifted by hot line tools or rubber gloves into the hooks provided. Only a few minutes is then required to change the cross arm. Two men have averaged changing one arm every seven minutes, by this method. Further information can be obtained from A. B. Chance Co., Centralia, Mo.

Acme Transformers

In a special bulletin just issued, The Acme Electric & Mfg. Co., of Cuba, New York, lists standard specifications and mounting means of audio transformers, driver transformers, interstage transformers, reactors, microphone input transformers for airborne equipment and transmitter transformers and reactors for mobile equipment.

In addition to the specifications covering such units, a chapter is devoted to the explanation of transformer compounding. The manufacturer asserts that transformers sealed with the proper compound can operate at a lower temperature rise than ordinary air-cooled transformers. The secret being that certain types of compound have the quality to dissipate heat more rapidly than ordinary free air.

The manufacturers offer to send this engineering bulletin No. 159 to anyone interested in the production of equipment in which transformer units of this type may be included.

Fluorescent Maintenance

How to properly care for your fluorescent installation — and get maximum lighting service from it is the subject of a new booklet just published by the Lighting Division of Sylvania Electric Products, Inc., titled "Timely Wartime Tips On Fluorescent Maintenance."

The booklet outlines the setting up of a regular maintenance routine —tells how to determine the frequency of a regular cleaning schedule—how to figure the number of lamp replacements per month. It gives the steps to follow in a regular checking system before discussing equipment and many other valuable suggestions to keep fluorescent installations at peak efficiency.

A copy of this pocket-size, ready reference booklet may be secured by writing Sylvania Electric Products, Inc., Lighting Division, Salem, Mass.

"Wartime Conservation"

"Wartime Conservation," a new 96-page booklet just published, contains recommendations by Westinghouse engineers for selecting, applying and using electrical equipment so as to achieve the best possible output with the greatest saving in critical materials.

The book covers up-rating of motors, thermal temperature loading of transformers, industrial network systems, line equipment and materials; and gives tips on saving and salvaging materials as practiced in the various Westinghouse plants.

In addition to pointing out ways of saving vital materials in new equipment purchased, the booklet gives many examples of how existing equipment can be made to give better service and greater output by up-rating or rebuilding with more efficient materials than originally used.

All recommendations in this new book are in line with policies suggested by the WPB for conservation of critical materials. A copy of booklet B-3206 may be secured from Department 7-N-20, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.

Distribution Transformers

Power and distribution transformers and other electrical distribution equipment important in maintaining an efficient flow of power to vital war industries are completely described in a new bulletin just issued to cover the entire line of this Allis-Chalmers equipment.

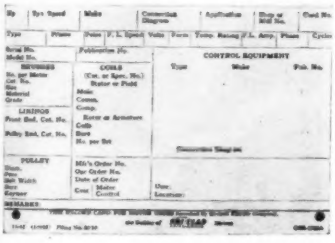
The new book discusses important wartime considerations such as the use of modern welded construction and standardization of design, which saves vital materials in manufacturing and provides the advantages of interchangeability in installation.

The new electro-cooler for increasing transformer capacity, and unit substations which simplify power control and distribution are two new developments treated in Bulletin B-6186. Others included are feeder voltage regulators, instrument and metering transformers, the oil-sealed inert gas system which protects transformer oil by isolating it from the outside air, and load-ratio-control for load regulating voltage, power factor and phase angle.

Copies of this Bulletin B-6186 are available on request from the Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.

Motor Record Card Available

Available from the General Electric Company, Schenectady, New York, to all maintenance engineers, is a motor record card (GES-1526A) of convenient size (4 by 6 in.) for card files and containing spaces on both sides for the recording of essential information on each motor as well as the nature and extent of inspections and repairs.

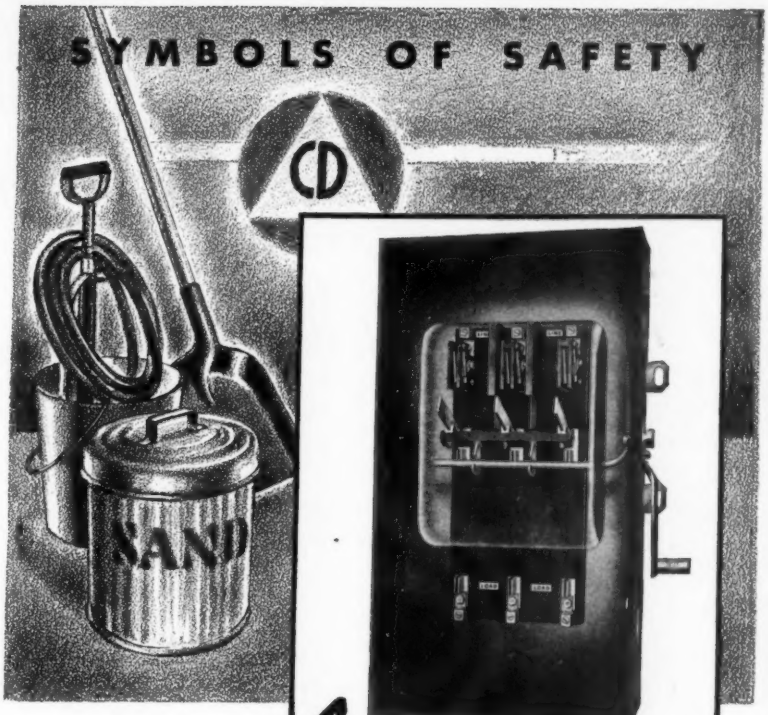


With the use of this card for each motor in the plant, the maintenance engineer has the motor's history right at hand. In this way, excessive amounts of attention or expense will show up and the causes can be determined and corrected.

Electrical Safety

An instructive 16-page booklet entitled "Electrical Safety in War Time" has been issued by the Public Relations Committee of the International Association of Electrical Inspectors. The booklet was prepared for distribution among householders. It discusses the maintenance of appliances and electrical cords, shock hazards, fuses, and permanent wiring of the home.

Copies of the booklet may be pur-



Federal Rolarc
SAFETY FACTORS

PREVENT MANPOWER SHORTAGES

Industrial accidents are one reason for manpower shortages. And uncontrolled arcing is one cause of industrial accidents. That's why special safety features are incorporated in Federal Rolarc Safety Switches to control and reduce dangerous arcing to an *absolute minimum* . . . and to increase production by eliminating delays and accidents caused by switch failure.

The parallel cylindrical rollers which "dam up" and snuff the arc give these 575 Volt Rolarc Safety Switches many added advantages. This new method of arc control lengthens switch life — conserves war vital copper — saves valuable time and priceless manpower. Follow the leaders — for extra service and safety switch to Federal!

For Complete Rolarc Data

Write for Bulletin 42-12. Contains all the essential facts on the 575 Volt Federal Rolarc Safety Switch.

Southeastern Representative
FULWILER and CHAPMAN
314 Luckie St., N. W., Atlanta, Ga.

FEDERAL ELECTRIC PRODUCTS COMPANY
60 PARIS STREET, NEWARK, N. J.

PANELBOARDS • SWITCHBOARDS • SAFETY SWITCHES • CIRCUIT BREAKERS

chased in quantities at the printer's cost of 2c per copy up to 1,000 copies and at $15.00 per 1,000 in quantities of 1,000 or more.

For further information write the Public Relations Committee, 85 John Street, New York City, N. Y.

Automatic Control Bulletin

Zenith Electric Company, manufacturer of automatic control equipment, has just published a new bulletin on the several units of its manufacture: Magnetic Contactors, Reversing Controls, Automatic Reset Timers, Process Timers, Program Clocks, Remote Control Switches, Automatic Transfer Switches, etc.

The bulletin gives details of construction, latest improvements, applications and prices. Users of such equipment may obtain copies of the bulletin by addressing Zenith Electric Company, 152 West Walton St., Chicago, Illinois.

Enzor Fixture Catalog

F. K. Enzor Company, of Columbus, Ohio, is announcing their new and attractive Spring Catalog which has now been mailed out to the electrical contractors and dealers throughout the South.

While their new catalog is somewhat smaller than usual it still shows a large selection of residential and commercial lighting. A good stock of the fixtures illustrated is now on hand.

With the uncertainties in getting a further supply, their present stock on some numbers illustrated may not last for the duration. They suggest that when placing orders, it will be advisable to mention a desirable substitute.

In order to make it possible to fill orders for the months ahead, they further suggest that customers limit the quantities they order as much as possible. This is an unusual request to make of their customers but it is really necessary now.

Flexible Bus-Drop Cable

A new loom bus-drop cable which carries power from bus bar to individual motor driven machines in war production plants, is announced by the Wire & Cable Section of General Electric Company's Appliance & Merchandise Department at Bridgeport, Conn.

The loom bus-drop cable can be used in new or conversion wiring or as a maintenance item. It can be hooked up easily and quickly in LVD or bus-duct systems. It is designed for long life under severe conditions such as vibration and rough usage, and it is neat in appearance.

Balance Sheet Analysis Helpful

(*Continued from page 36*)

that goodwill is listed at $1 on this balance sheet—a wise practice.

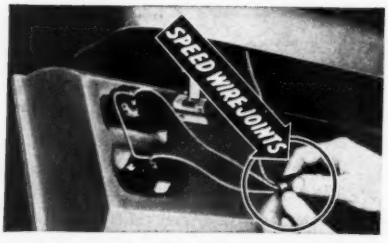
Current liabilities consist of open accounts, short-term obligations, accrued items, such as payroll and taxes. Do the accounts payable show a reasonable relationship to inventories or does their large total indicate failure to pay promptly? This balance sheet shows $2,850 in accounts payable and $5,050 inventory so the comparison does not indicate laxity in paying suppliers for materials.

Are the bank loans high? If so, it indicates good banking connections or that borrowings are at peak and working capital is being strained, non-existent in this case, because the working capital is ample, otherwise, the difference between $15,225 current assets and $7,145 current liabilities, or $8,080.

Check loans payable to determine if they are paid off as due or renewed continually. If the latter, it would seem that the contractor considers current loans as fixed liabilities and should payment be demanded, embarrassment may follow. Current loans should be borrowed only to settle current indebtedness. It is usually poor policy to borrow current short-term loans to buy fixed or slow assets. Continual renewal of current loans is a danger signal. Unless reduced consistently, your business may suffer a heart attack.

Fixed liabilities — mortgages, bonded indebtedness and long-term notes—should be checked in detail at set periods to disclose the residual value of assets under mortgage or bond.

Net worth includes reserves, capital and surplus of a corporation. The net worth of an individual or partnership is the difference between the assets and liabilities, including the reserves for depreciation. The higher the debt to net worth, the greater the business risk. If the liabilities or debt exceeds the net worth, the condition is precarious. On the accompanying statement, the fixed assets exceed the net worth, indicating a trend toward business expansion and the curtailment of adequate working capital, which should be checked.



UNRESTRICTED!

IDEAL Wire-Nuts

Solderless, Tapeless Wire Connectors

By WPB order, solder joints are prohibited wherever another product meeting electrical requirements can be used. IDEAL "Wire-Nuts" is the product that fills the bill. They use none of the critical materials—tin, lead or rubber required for solder and tape joints. They're applied faster, inspected faster, OK'd faster. IMMEDIATELY AVAILABLE!

KNOCK OUT Wiring Jobs FAST by Giving Wire Joints

"THE NEW ONE-TWO"

1—Strip Wires 2—Screw on. THAT'S ALL!

Thousands of wiring contractors are rushing war wiring jobs to completion this faster, easier, safer, surer, "Wire-Nuts" way. Carry "Wire-Nuts" in your pockets and *apply cold.* Make a better joint electrically, stronger mechanically. SIZES FOR EVERY JOB. Fully approved. Listed by Underwriters' Laboratories, Inc. Write for FREE Samples. No Delivery Delays.

PROMPT SHIPMENT

IDEAL SOLD THROUGH JOBBERS

IDEAL COMMUTATOR DRESSER COMPANY

1017 Park Avenue Sycamore, Illinois

SALES OFFICES IN ALL PRINCIPAL CITIES

"HAPPY LANDING"
place for a pep-restoring rest on an inner-spring mattress in a noise-proofed, comfortable room . . . then a satisfying meal, and a fresh start.
hotel Mayfair
St. Louis
Over 50% of all rooms $3.50 or less sin

Business ownership should contribute more than the fixed capital or fixed assets, the additional contribution falling under the head of current assets, hence, part of working capital. The net worth is incorrect if other balance sheet accounts are too high or too low. The larger the ratio of sales to net worth, the less the percentage of net profit needed to earn a given rate of return on investment. Figure the profit on net worth — a high return means good management.

Servicing the Refrigerator

(Continued from page 28)

orator requiring a float change. Always balance the pressure before removing the service valve or float. Care should be used when changing a float on a low temperature evaporator. If the evaporator temperature is below the dew point of the air surrounding the opening, moisture will be condensed out of any air that enters the float chamber. The nearer the evaporator temperature is to room temperature before the chamber is exposed, the better. Use every precaution to prevent moisture entering the system.

The needle and seat are replaceable in the field in most low side floats. The seat is pressed into the face plate and can be pushed out by a press and a new seat pressed into place. The new needle is put into place using new cotters and pins if necessary. Tap the needle lightly until the valve does not leak.

To test for leaks, attach a refrigerant cylinder to the inlet and turn the float so the ball will hold the needle closed. Place refrigerant oil around the needle and seat, and tap lightly until the bubbles disappear. If it is desirable to change the calibration, do not bend the float arm more than 1/8" at a time, then try the float for proper operation. This is the only practical method for field work. For shop work, a calibration chamber is used to hold the calibration fluid. A calibration chamber can be easily made by cutting the top out of a discarded evaporator header. Use a float that is correct to establish the proper liquid cut-off level. Use a liquid in the chamber that will not injure the float parts or mechanism. Orthodichlorobenzene

Why Waste Time and Lose Orders by Shopping Around?

• Today speed counts more than ever. Spero will back you up with *prompt deliveries* on five complete lines of quality electrical products, *priced right.* Speed your estimates, and guarantee quicker deliveries by quoting only from this one reliable source. Here are a few leading items:

SPERO DUR-O-LITE FLUORESCENT FIXTURES

Available with non-metallic reflector and raceway with as little as 6 ounces of steel per foot. The only fixture made of synthetic resin bonded plywood, cutting steel requirement 90%. Meets Bureau of Standard reflector specifications.

with INSTA-LITE

New Spero - development provides instantaneous lighting, eliminating starter and maintenance due to starter troubles.

SURFACE CABINETS

All sizes—hinged on long or short sides. Concentric knockouts as required.

SHALLOW AND DOME TYPE REFLECTORS

Approved Government Types — One-piece, seamless spun construction. Also glass-steel diffusers. Made in lamp sizes of 75 to 750 watts.

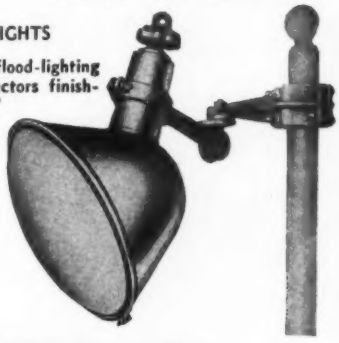
With and without sockets.

WIRE-HOLDERS

One, two or three point wire-holders and brackets with metal cap-assembly (Pat. Pending) reinforcing porcelain against breakage.

FLOOD LIGHTS

Wide variety of flood-lighting equipment. Reflectors finished in "Duralum."



SWITCH PLATES

Unbreakable plates — brown or ivory. Durable baked-on wrinkle finish.

SPERO NOW MAKES NAVY 9S FITTINGS

To meet the demand for 9S Series fittings for the U. S. Navy, Spero now offers a complete line of steel drawn boxes —in 3", 4", and 5" sizes, manufactured according to Navy drawings.

SPERO ...5 LINES of Products from one dependable source

THE SPERO ELECTRIC CORPORATION
18222 LANKEN AVE. ★ CLEVELAND, OHIO

is suitable for sulphur dioxide and Freon floats as the specific gravity is near that of these two refrigerants.

Refrigerant Charge

The refrigerant charge is not critical as long as there is sufficient liquid in the receiver to cover the liquid outlet. This is satisfactory for a minimum charge.

The liquid receiver may usually be one-half full of liquid refrigerant and still leave ample room to pump down the system. The maximum change in the average system is the pump down capacity of the receiver. Most service work may then be performed without the necessity of drawing out part of the charge into an auxiliary drum.

Electronic Speed Control for Motors

(*Continued from page 20*)

constant torque. The horsepower output will decrease in proportion to the decrease in speed. When operating at speeds above basic, during which it has full-armature voltage and reduced field voltage, the motor will provide constant horsepower and reduced torque output. This is illustrated by Fig. 5 which shows the torque and horsepower curves for the full operating range. Fig. 5 also illustrates how the speed is increased by armature voltage as the speed adjusting potentiometer is turned from zero to midposition, and how the motor operates by field weakening from midposition to the point where the knob is turned to the extreme clockwise position.

Many intresting applications of the Thy-mo-trol drive have been made—most of them to machine tools because of the present limitations in size. Among the types of machines to which drives have been successfully applied are grinders, milling machines, tool-room lathes, turret lathes, and thread mills. In addition, they have been supplied for automatic welding machines and for various special equipments for testing magnetos, airplane propeller governors, and instrument tachometers. Fig. 6 shows a standard Thy-mo-trol panel applied to a milling machine. Fig. 7 shows a control panel built into a form and thread milling machine.

Power Helps Win the War

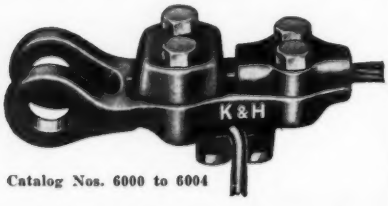
(*Continued from page 16*)

capacity can be safeguarded for war industries. It is recognized that this course of action is a costly one from the point of view of the country's power systems, but I am sure that no one would tie up a turbine producing electricity for neon signs and show windows when such turbines are vitally needed to power war ships. Capacity will be available to meet all necessary requirements. Wise planning in the interest of winning the war will not permit investing material and labor in power facilities which contribute only to luxuries.

While power capacity is generally adequate, serious difficulties are already being experienced in the transportation of fuel to meet the greatly increased requirements of war production and off-shore shipments. In planning new power capacity, we have given preference to hydro wherever possible to save fuel. But steam power is predominant in a number of areas and important in nearly all. Power systems in many sections of the country utilize large quantities of fuel, and in some areas this fuel must be transported hundreds of miles. For this reason there has been some discussion of the possibility of reducing non-essential uses of electric power for the purpose of conserving fuel and transportation. Such a program would involve the curtailment of all non-essential lighting and other luxury uses of power in those areas where a saving in fuel and transportation would result. Whether or not such a dimout is needed is a matter which must be determined by the Government agencies primarily responsible for fuel and transportation. Some persons mistakenly believe that a nation-wide dimout is being advanced to take care of a power shortage. There is, of course, no need for a "dimout" of the nation's cities from the standpoint of power supply because there is no present or impending shortage of power capacity. As I have already indicated, curtailment of power use may be necessary from time to time in case of outages, unusual drought, sabotage, or unavoidable delays in

A line wire is no better than its Connections

DEAD END CLAMPS
for Aluminum Line



Catalog Nos. 6000 to 6004

Protects Aluminum Strands Against Crushing . . . Grips Steel Core Separately . . . Provides Bi-Metal Tap-Off Connector

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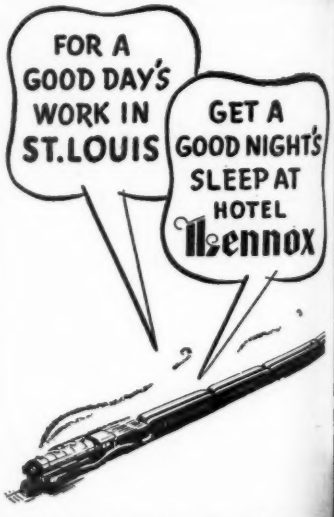

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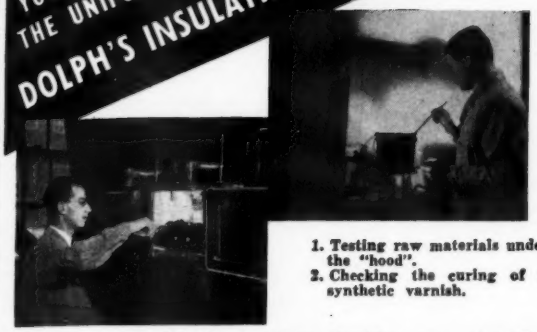

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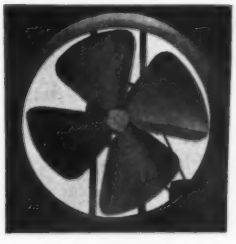

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installing the new capacity that is now under construction; but such measures, in contrast to power curtailment to save fuel and transportation, would be only for temporary periods and local areas.

We in the War Production Board fully appreciate that the war power supply job can be done only by the systems who are directly responsible for supplying power to the public. It is only through our combined efforts that power has not been "too little and too late". In the periods of emergency which lie ahead, it is your great natural ability to get the most out of what you have that will assure continuous and adequate power supply. You will not have all the material you want; you will not have all the labor you want; during some periods, you may not have all the capacity you want; but we know that you appreciate that you can make your maximum contribution to the war only by doing your job with the minimum of everything so that the country can devote its full resources to a vigorous prosecution of the war.

May I express the appreciation of the war agencies for the substantial contribution which the power systems in this area have made in the war, and wish you continued success in your efforts to see to it that the public has enough power for its essential needs.

Project Organization For Large Installations

(Continued from page 13)

circuitous route, in order to avoid narrow tunnels, overhead clearances, etc.

Materials for this job were obtainable under high priorities. However, the services of expediters were necessary in order to secure the materials as quickly as needed, because of the speed with which this project went forward.

"A project such as this," said Mr. Juneman, "is a cooperative undertaking in which the general contractors and all sub-contractors must work in harmony. My objective, especially, is to work closely with the general contractor and not to hold him up on any phase of the work."

While handling these larger jobs, Juneman has usually had several smaller ones under way at the same time, requiring that he spend about one-half of his time on the road. Other jobs handled by his concern during the past year or so include the shell machining and forging plant of U. S. Pipe Company, the shell machining plant of National Cast Iron Pipe Company, the ore conditioning plant of the Republic Steel Company, and an oxygen plant of Air Reduction Sales Company, in Mississippi.

These government jobs were done either on cost-plus-a-fixed-fee or cost-plus-percentage basis, and it is a tribute to Mr. Juneman's integrity and ability that he was called in on them, usually by the general contractor. He has shown his ability to handle a large organization, although he has only been in business a few years.

Mr. Juneman is a member of the National Electrical Contractors Association. To this association he gives much credit for their efforts in seeing that the electrical work on defense jobs is handled by electrical contractors, rather than by general contractors or branches of the Government.

"In our maintenance work for local industries engaged in war work, our objective is to get the machine or lighting back in operation as quickly as possible," said Mr. Juneman. "That sometimes means a temporary repair to be followed later by a complete job. That is because one machine may hold up a whole plant or a whole battery of other equipment."

Mr. Juneman stated that service calls result from various causes and, for that reason, the electrician usually takes along a truck full of equipment including testing apparatus, fuses, wiring, ladders etc, — in short, all the materials needed for emergency repairs. Such jobs are taken only on a time and material basis.

Mr. Juneman said the practice of some concerns when they had electrical work was to call on several contractors for bids. However, he said that if the job is relatively small, the firm should select one contractor in whom it has confidence, and call him to do the work. It is his intention to build good will among his customers, so that they will call him on repeat jobs and whenever they have major extensions to make to their establishments.

Although Mr. Juneman has been fortunate in having so much war work to handle during the period when other new construction is restricted, he still prefers private work for several reasons. He anticipates a private construction boom after the war is over, and feels his experience with the big jobs will be of invaluable help to him.

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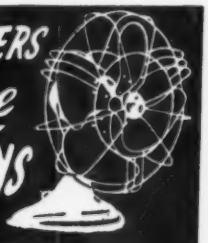

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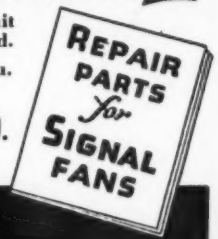

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ADVERTISER'S INDEX

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A
Adam Electric Co., Frank 5
Aluminum Co. of America 41
American Coolair Corp. 55
American Steel & Wire Co. 51
Anaconda Wire & Cable Co. 4

B
Biddle Co., James G. 63
Briegel Method Tool Co. ..... *
Bright Light Reflector Co., Inc. 57
Bull Dog Electric Products Co. 53
Burndy Engineering Co., Inc. 53

C
Crescent Insulated Wire & Cable Co. ..... *
Curtis Lighting, Inc. ..... *

D
Dolph Co., John C. 60

E
Edison General Electric Appliance Co. ..... 24 and 25
Enzor Co., F. K. 60

F
Federal Electric Products Co., Inc. 61
Frigidaire Division ..... *

G
General Cable Corp. ..... 44 and 45
General Electric Co. (Appliances) ..... 30 and 31
General Electric Co. (Insulating Materials) 47
General Electric Co. (Lamps) ..... *
General Electric Co. (Wiring Materials) ..... Back Cover
Georgia Power Company ..... Inside Back Cover
Graybar Electric Co. 60
Greenlee Tool Company 58

H
Hazard Insulated Wire Works 1
Hotel Hollenden ..... *
Hotel Lennox 64
Hotel Majestic 57
Hotel Mayfair 63
Hubbard & Company ..... *
Hunter Fan & Ventilating Co., Inc. ..... Front Cover

I
Ideal Commutator Dresser Co. 60
Insulation & Wires, Inc. 67

J
Johns - Manville ..... *

K
Krueger & Hudepohl 64

L
Lloyd Products Co. 60

M
Magazine Publishers 3
McGill Mfg. Co. 60

N
National Electric Products Corp. 54

O
Okonite Company ..... *

P
Penn-Union Electric Corp. 59

R
Robbins & Myers, Inc. 59
Rogers, C. B. ..... *

S
Sangamo Electric Co. 52
Schwitzer-Cummins Co. 62
Signal Electric Mfg. Co. 62
Spero Electric Co. 62
Square D Company ..... *
Sticht Co., Inc., Herman A. 60
Sylvania Electric Products, Inc. ..... *

U
United States Steel Co. 52
Uptegraff Mfg. Co., R. E. 6

W
Walker Brothers 57
Ward-Leonard Electric Co. 62
Westinghouse Electric & Mfg. Co. (Appliances) 10
Westinghouse Electric & Mfg. Co. (Lamps) ..... 2 and 3
Westinghouse Electric & Mfg. Co. (Motor Controls) ..... Inside Front Cover
Wiegand Co., Edwin L. 61
Wiremold Company 7

Y
Youngstown Sheet & Tube Co. 8